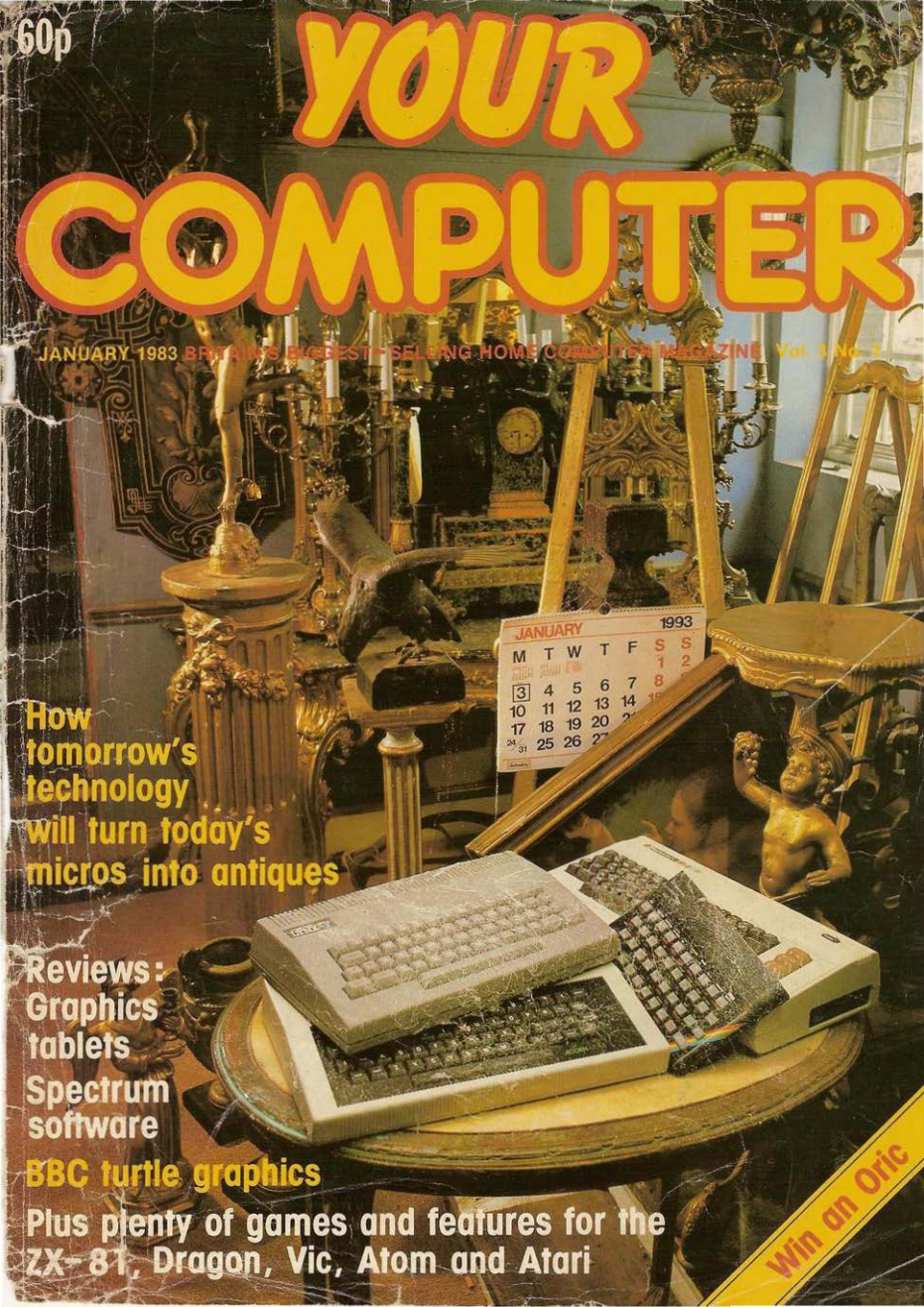
60p

YOUR COMPUTER

JANUARY 1983 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol. 3 No. 1



How tomorrow's technology will turn today's micros into antiques

Reviews: Graphics tablets Spectrum software

BBC turtle graphics

Plus plenty of games and features for the ZX-81, Dragon, Vic, Atom and Atari

Win an Oric

Spectrum Software

Meteroids • 3D Tanx • Centipede

AVAILABLE NOW! £4.95 Each

Features: Fast machine code, full colour, fantastic sound effects and define your own play keys

Send off the coupon today or telephone Gt. Yarmouth (0493) 602453 (24 hrs a day, 7 days a week) giving your Barclaycard or Access number.

dk'tronics

23 Sussex Road,
Gorleston,
Gt. Yarmouth,
Norfolk.
Tel: (0493) 602453

Access

BARCLAYCARD VISA

Name .....

Address .....

.....

Please send me ..... Meteroids ..... 3D Tanx
..... Centipede @ £4.95 each inc. P&P

I enclose cheque/PO payable to DK Tronics Total £
or debit my Access/Barclaycard.

Signature .....

YOUR COMPUTER

YOUR LETTERS 27
Acorn's Hermann Hauser accuses Sinclair of false claims; program gremlins.

NEWS 28
Casio's PB-100 personal computer; Vic double-Dutch memory; phoneme speech pack.

COMPUTER CLUB 31
Our man with the binoculars and spy camera visits Cheltenham's computerniks.

TOMORROW'S TECHNOLOGY 34
Meirion Jones traces the shape of computers to come which will put today's micros in the antique shop.

VIC ADD-ONS 40
Three ways of making the most of your Vic-20 reviewed by Ken Ryder.

GRAPHICS TABLETS 46
Now you can feed pictures straight into a BBC or Spectrum. Simon Beesley finds out if direct input is worth the money.

SPECTRUM SOFTWARE 50
Latest releases reviewed — including a Hobbit adventure which claims to use artificial intelligence.

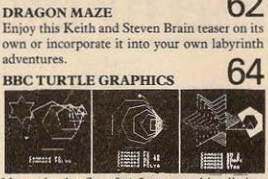
VIC SPACE RUNNER 54
Can you escape cosmic oblivion and outrun the flying saucers?

SPECTRUM CROSS 56
If you can evade the juggernauts and man-eating spiders, Stuart Nicholls will still set his crocodiles on you.

FROGGER 61
The elusive last program of our ZX-81 games-writing series.

DRAGON MAZE 62
Enjoy this Keith and Steven Brain teaser on its own or incorporate it into your own labyrinth adventures.

BBC TURTLE GRAPHICS 64



Not only the first full Logo graphics listing published in a magazine but also on page 69 several turtle demonstration programs.

ATOM WORD PROCESSOR 72
Geoff Byrns presents yet another useful program for the Atom.

ZX-81 LIFE 75
A fast, machine-code version of the generation game.

ATARI CHARACTERS 78
The software to produce the games characters and alphabets of your choice.

ZX-81 CHESS 81
Part 2 of David Horne's series on writing a full chess program in 1K.

VIC MULTI-COLOUR GRAPHICS 85
Martin Howse looks at the Vic's potential for special graphics effects.

ZXTRA-WIDE TEXT 88
Add extra character to your ZX printouts.

BASIC DICTIONARY 91
Tony Edwards' Basic lexicon.

SPECTRUM ROM 93
David Horne shows you how to make real use of the disassembled ROM.

CONTROL 96
The attention focuses on standard interfaces in John Dawson's study of control.

RESPONSE FRAME 101
Your technical queries answered.

FINGERTIPS 103
Our pocket computer and calculator column.

SOFTWARE FILE 107
Ten pages packed with programs for the ZX micros, BBC, Atom, Vic and others.

COMPETITION CORNER 121
The result of November's puzzle and a new £15 competition. The Oric competition falls between pages 26 and 27.

Cover photograph by Stephen Oliver.

Editor
TOBY WOLPE

Assistant Editor
MEIRION JONES

Staff Writer
SIMON BEESLEY

Sub-editor
PAUL BOND

Editorial Secretary
LYNN COWLING
Editorial: 01-661 3144

Advertisement Manager
PHILIP KIRBY 01-661 3127

Advertisement Executives
BILL ARDLEY 01-661 8484
PETER RICE 01-661 8441

Midlands Office
KEITH SALT 021-356 4838

Northern Office
RON SOUTHALL 061-872 8861

Advertisement Secretary
JEANETTE MACKRELL

Publishing Director
CHRIS HIPWELL

Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Subscriptions: U.K. £8 for 12 issues.

© IPC Business Press Ltd 1983

Typesetting by In-Step Ltd, London EC1.
Printed by Riverside Press Ltd, Whitstable, Kent.
Published by IPC Electrical-Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG. ISSN 0263-0885

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

EDITORIAL

SO THAT WAS IT 82. If the most impressive failing of the Government's year-long £2 million crusade to promote new technology was that very few people were aware of its existence, at least we can rest easy in the knowledge that "information technology" — the woolly jargon coverall apparently invented for the occasion — never quite made it into everyday vocabulary either. The organisers claim that IT 82 was a success; after all, a recent MORI survey showed that 62 percent of the population had heard of IT. A similar proportion of the country may have heard of quantum mechanics but few will have any idea of its effects on current or future life.

That a few people did notice something going on can probably be put down to Information Technology year's incongruously low-technology methods for seeking publicity. Those whose memories have not been too badly shot away by machine code may recall, for example, the wind-powered yacht launched in the summer and symbolically named *Information Technology*, or perhaps with less of an effort remember last autumn's inordinately long postage stamps which made use of their extra length to fend off electronic mail and put over a brief hi-tech slogan.

In a few years time, when antique dealers are bidding fiercely at Sotheby's for a pristine ZX-80, certain professional historians will undoubtedly try to make a living out of computing as their specialist subject. One of these academics may well try to make out the case that IT 82 was responsible for the boom that took place in home computing the same year. It is the sort of mistake that historians should be forgiven for making — especially when one looks dispassionately at the astounding progress that has been made in the last year. A year ago home computers were silent, black and white, low resolution, twice as expensive, had half as much memory and — as a result of all that — were three times rarer than today.

Now home computers are something worth having and at a price that is within the reach of the ordinary person. In 1982 computing moved out of the hobbyists' domain and into the consumer market. That transformation has far more to do with the demystification of computing and the new technology than a whole decade of Information Technology years. The process of educating the public about the benefits and dangers of the new technology must continue indefinitely. If it does not, those historians of the future may remember IT 82 rather as they remember the Great Exhibition of 1851 — a magnificent display of all that was latest in science and technology followed by years of neglect and a rapid decline. ■

HAYDEN BOOKS

SOFTWARE GOURMET GUIDE & COOKBOOK SERIES FOR 6502, Z80, 8080, AND 6800 PROGRAMMERS

Essential guides designed to take BASIC language programmers into the realm of machine language programming. The complex chip instruction sets are clearly and carefully explained. Descriptions of the fundamental elements of each CPU including the program counter, index registers, stack pointer, memory, and status flags, stress the creative advantages and programming power of each chip. General purpose subroutines, input output processing, floating point routines are discussed in depth. Each volume contains appendixes with the instruction set mnemonics and machine codes, octal to hexidecimal conversion table, and ASCII character set.

6502 Software Gourmet Guide & Cookbook	08104 6277X	approx. 250pp	Feb'83	approx. £10.70
Z80 Software Gourmet Guide & Cookbook	08104 62761	approx. 250pp	Feb'83	approx. £13.90
8080 Software Gourmet Guide & Cookbook	08104 6208X	approx. 250pp	Feb'83	approx. £10.70
6800 Software Gourmet Guide & Cookbook	08104 62818	approx. 250pp	Feb'83	approx. £10.70

INTRODUCTION TO COMPUTER ANIMATION

by **N. Wadsworth**

Now you can produce amazing computer graphics - even if you can't draw a straight line. Learn how to draw lines and shapes, make graphs, draw pictures, and even do animation. Popular microcomputers such as the Apple II, Radio Shack's TRS-80 and the Commodore PET, are capable of producing low-resolution graphics. Now you can use low-resolution graphics to improve the presentation and impact of almost anything you want your microcomputer to do. It can be used to animate games or data, clarify educational materials, or just plain entertain.

Feb'83 approx. 120pp
0 8104 6279 6 approx. £8.20

CREATE WORD PUZZLES WITH YOUR MICRO-COMPUTER

by **E.E. Mau.**

A handy guide that enables home computer users to create their own acrostics, cryptograms, word-finds, quote-falls, fill-ins, and other word puzzles. There are 17 BASIC Programs for producing 25 puzzles - either blank puzzles with answer keys or printouts following puzzle magazine format.

Feb'83 approx. 180pp
0 8104 6251 6 approx. £12.35

CODES, CIPHERS AND COMPUTERS:
An Introduction to Information Security

by **B. Bosworth**

In addition to describing the fundamentals of secret communication, the book provides an understanding of computer security through computer cryptography. It details and illustrates traditional cryptography techniques developed before computers and discusses more recent concepts for the highest levels of information and data security, such as the NBS Data Encryption Standard and the Public Key Cryptosystem.

Nov'82 approx. 348pp
08104 51490 approx. £10.30

THE 8086/8088 PRIMER
An Introduction to their Architecture, System Design, and Programming, 2nd Edition

by **S.P. Morse**

Written by the man responsible for the design of the 8086 microprocessor, this revised edition has been updated to provide novices and professionals alike with a thorough introduction to Intel's 8086 and 8088 microprocessors.

Sept'82 288pp
08104 6255 9 £8.75

BASIC COMPUTER PROGRAMS FOR BUSINESS Volume 2

by **C.D. Sternberg**

Designed for small businesses, microcomputer entrepreneurs, and independent consultants, this book provides an invaluable variety of aplication programs that will make your microcomputer pay for itself as soon as it enters your office. Includes over 70 complete programs that can be used on a daily basis for critical facets of a business operation. Each program can be easily modified to meet your business's specific needs.

Oct'82 (paper only) 384pp
08104 5178 6 £11.50

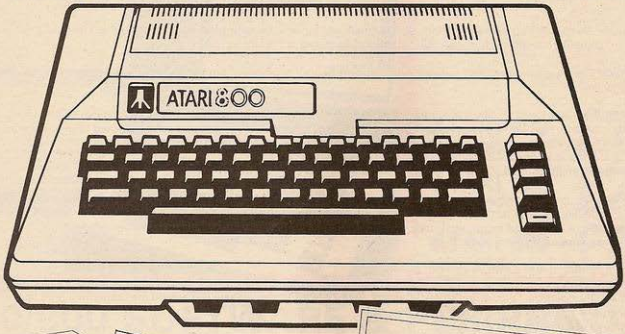
WILEY COMPUTER BOOK MONTH FEBRUARY 1983

A wide range of Computer books and Software on display at leading Bookshops and selected Computer stores throughout the UK.
(Checklist of titles available from Wiley)

Hayden Books available from all good Bookshops and Computer Stores —
or from John Wiley & Sons Ltd.
A complete list of all Hayden Books and Software is available on request.

Marketed by
John Wiley & Sons Limited
Baffins Lane · Chichester · Sussex PO19 1UD · England

WHAT A NEW YEAR PACKAGE FROM COMPUTERS FOR ALL



ATARI 800
NEW LOW PRICE
£399.95

There's a computer to suit you at Computers for All!
A full range of the world's finest micros plus the best advice and tremendous value for money!
New Year, so why not a new computer? Choose from the Atari range, Dragon, Oric, MPF II, BBC Micro, Commodore.
But be sure it's from Computers for All — the shop where people matter.
Call now, write or phone.
1983 will definitely be the year of the computer.
Make sure you start it right.
INSTANT CREDIT AVAILABLE FOR CALLERS WITH CHEQUE OR CREDIT CARD

Post today, phone, or call at our shop
Post to Computers for All (Y), 72 North Street, Romford, Essex. Telephone: (0708) 752862.

Please rush me the following equipment:

..... ORIC 48K @ £169.95 (inc VAT)
..... BBC MICRO (B) @ £399.00 (inc VAT)
..... DRAGON 32 @ £199.50 (inc VAT)
..... MPF II @ £270.00 (inc VAT)
..... ATARI 400 @ £199.95 (inc VAT)
..... ATARI 800 @ £399.95 (inc VAT)

Please add Post and Packing @ £3.00.

DRAGON CARTRIDGES		DRAGON CASSETTES	
Ghost Attack	@ £24.95 ea	Compendium of Games	@ £7.95 ea .....
Berserk	@ £19.95 ea	Comp. of applications	@ £7.95 ea .....
Meteoroids	@ £19.95 ea	Quest	@ £7.95 ea .....
Cosmic Invaders	@ £19.95 ea	Madness & the Minatour	@ £7.95 ea .....
Cave Hunter	@ £19.95 ea	Computavoice	@ £7.95 ea .....
Tube Frenzy	@ £19.95 ea	Graphic Animator	@ £7.95 ea .....
Starship Chameleon	@ £19.95 ea	Mazerace	@ £7.95 ea .....
Personal Finance	@ £19.95 ea		

NAME .....

ADDRESS .....

.....

I enclose cheque/P.O. to the value of £ ..... made payable to COMPUTERS FOR ALL. Please bill my Access/Barclaycard/Visa/Mastercharge/Amex No:

COMPUTERS FOR ALL

"THE SHOP WHERE PEOPLE MATTER"

AMSOFT

THE NEW RANGE OF SOFTWARE DEVELOPMENT TOOLS FOR THE ZX81 AND SPECTRUM USER

Amersham Software Ltd. exists to provide software aids for those users who need to get the most out of their ZX81 and Spectrum computers without using expensive additional hardware.

All **AMSOFT** products are designed to work with standard Sinclair equipment, but can be used to generate code for other devices as well.

AM-ZXFILE is a bulk cassette data handler for the ZX81 BASIC user. Unlimited numbers of data records can be written to, or read from, cassette files, in the same program if you wish. Records can vary in length, and can be blocked together in groups of any size for greater speed. Speed of output is controlled by the user program, and missing data is detected on reading. All output and input is from a BASIC array.
Big machine facilities at £4.00 inc VAT

AM-ZXMON is a complete machine code *operating system* for the ZX81. The user can create, modify, move and verify machine code. He can also run and checkpoint machine code programs. Most important, he can create libraries of machine code routines on tapes, and merge them together, and with new programs, to speed program development.
A first class support system at £6.00 inc. VAT

Under the control of **AM-ZXMON** you can run—

AM-ZXEDIT a text editor primarily designed for creating assembly language source text files on cassettes, for input to the **AM-AZON** assembler. Similar to the BASIC editor, **AM-ZXEDIT** lets you create and amend the programs line by line, and to merge different program cassettes together.
A must at £4.00 inc. VAT

NEW AM-AZON full two pass symbolic assembler running under the control of the monitor AM-ZXMON and producing either directly loadable binary cassettes or relocatable code suitable for the AM-ZXDOC relocating loader. Symbols of up to 5 characters can be used instead of absolute addresses, hex. and decimal constants and text may be used. ABS, ORG, EQU, EXTN, are all provided and the assembler supports all Z80 op. codes. It is impossible to describe this product in a small space.
The best assembler around at £8.00 inc VAT

COMING SOON is **AM-ZXLOC**, a full relocating loader which will merge together routines produced by AM-AZON and relocate them, completing any necessary linkages, giving a binary program. No more manual address changing, no more wasted space.

ORDER FORM HERE, space for four products on it.

TO: **AMERSHAM SOFTWARE LTD, LONG ROOF, HERVINES ROAD, AMERSHAM, BUCKS. HP6 5HS.**

Please send me ..... ☐ AM-ZXMON also ..... ☐ AM-ZXEDIT
and ..... ☐ AM-ZXFILE ..... ☐ AM-AZON

I enclose my cheque/postal order for £..... made payable to Amersham Software Ltd.

NAME.....

ADDRESS.....

.....

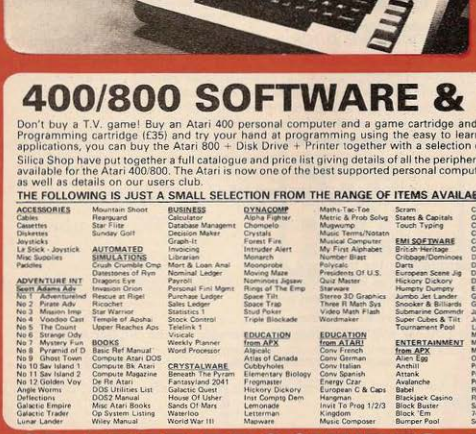
..... YC01

100 FREE PROGRAMS

FROM SILICA SHOP — WITH EVERY PURCHASE OF AN

ATARI 400 800

ATARI



ATARI PRICES REDUCED

We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 800 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01-301 1111 or 01-309 1111.

ATARI 400 with 16K £199

ATARI 400 with 32K £248

ATARI 800 with 16K £449

400/800 SOFTWARE & PERIPHERALS

Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.

THE FOLLOWING IS JUST A SMALL SELECTION FROM THE RANGE OF ITEMS AVAILABLE:

ACCESSORIES
Cables
Cassettes
Diskettes
Joysticks
Le Stick - Joystick
Misc Supplies
Paddles

ADVENTURE INT
Scott Adams Adv
No 1 Adventureland
No 2 Pirate Adv
No 3 Mission Imp
No 4 Voodoo Cast
No 5 The Count
No 6 Strange Ody
No 7 Mystery Fun
No 8 Pyramid of D
No 9 Ghost Town
No 10 Sav Island 1
No 11 Sav Island 2
No 12 Golden Voy
Angle Worms
Deflections
Galactic Empire
Galactic Trader
Lunar Lander
Mountain Shoot
Rearguard
Star Fleet
Sunday Golf

AUTOMATED SIMULATIONS
Crush Crumble Cmp
Datestones of Ryn
Dragons Eye
Invasion Orion
Rescue at Rigel
Ricochet
Star Warrior
Temple of Apsha
Upper Reaches Apo

BOOKS
Basic Ref Manual
Compute Atari DOS
Compute Bk Atari
Compute Magazine
De Re Atari
DOS Utilities List
DOS2 Manual
Misc Atari Books
Op System Listing
Wiley Manual

BUSINESS
Calculator
Database Managemt
Decision Maker
Graph-It
Invoicing
Librarian
Mort & Loan Anal
Nominal Ledger
Payroll
Personal Fin! Mgmt
Purchase Ledger
Sales Ledger
Statistics 1
Stock Control
Telelink 1
Visicalc
Weekly Planner
Word Processor

CRYSTALVARE
Beneath The Pyram
Fantasyland 2041
Galactic Quest
House Of Usher
Sands Of Mars
Waterloo
World War III

DYNACOMP
Alpha Fightar
Chompelo
Crystals
Forest Fire
Intruder Alert
Monarch
Moonprobe
Moving Maze
Nominoes Jigsaw
Rings of The Emp
Space Tilt
Space Trap
Soul Poker
Triple Blockade

EDUCATION from APX
Algebalk
Atlas of Canada
Cubbyholes
Elementary Biology
Frogmaster
Hickory Dickory
Inst Compng Dem
Lemonade
Letterman
Magwarn
Maths-Tac-Toe
Metric & Prob Solvg
Mulpwump
Music Terms/Notatn
Musical Computer
My First Alphabet
Number Blast
Polycalc
Presidents Of U.S.
Quiz Master
Starware
Stereo 3D Graphics
Three R Math Sys
Video Math Flash
Wordmaker

EDUCATION from ATARI
Conv French
Conv German
Conv Italian
Conv Spanish
Energy Czar
European C & Caps
Hangman
Inuit To Prog 1/2/3
Kingdom
Music Composer
Scram
States & Capitals
Touch Typing

EMI SOFTWARE
British Heritage
Cribbage/Dominoes
Darts
European Scene Jig
Hickory Dickory
Humpty Dumpty
Jumbo Jet Lander
Snooker & Billiards
Submarine Commdr
Super Cubes & Tilt
Tournament Pool

ENTERTAINMENT from APX
Alien Egg
Anthill
Attank
Avalanche
Babel
Blackjack Casino
Block Buster
Block 'Em
Bumper Pool
Castle
Centurion
Checker King
Chinese Puzzle
Codecracker
Comedy Diskette
Dice Poker
Dog Daze
Domination
Downhill
Eastern Front
Galahad & Holy Grl
Graphics/Sound
Jax-O
Jukebox
Lookahead
Memory Match
Midas Touch
Minotaur
Outlaw/Howitzer
Preschool Games
Pro Bowling
Pushover
Rabbotz
Reversi II
Salmon Run
747 Landing Simul
Seven Card Stud
Sleazy Adventure
Solitaire
Space Chase
Space Trek
Sultans Palace
Tact Trek
Terry
Wizards Gold
Wizards Revenge

ENTERTAINMENT from ATARI
Asteroids
Basketball
Blackjack
Centipede
Chess
Entertainment Kit
Missile Command
Pac Man
Space Invaders
Star Raiders
Super Breakout
Video Easel

ON LINE SYSTEMS
Crossfire
Frogger
Jawbreaker
Mission Asteroid
Mouskattack
Threshold
Ulysses/Golden Fl
Wizard & Princess

PERIPHERALS
Centronics Printers
Disk Drive
Epson Printers
Program Recorder
RS232 Interface
Thermal Printer
16K Memory RAM
32K Memory RAM

PERSONAL INT from APX
Adv Music System
Banner Generator
Blackjack Tutor
Going To The Dogs
Keyboard Organ
Morse Code Tutor
Personal Fitness Prg
Player Piano
Sketchpad

PROGRAMMING AIDS from Atari
Assembler Editor
Disembler (APX)
Microsoft Basic
Pascal (APX)
Pilot (Consumer)
Pilot (Educator)
Programming Kit

SANTA CRUZ
Basics of Animation
Bobs Business
Display Lists
Graphics Machine
Kids 1 & 2
Horizontal Scrolling
Master Memory Map
Min Word Processor
Page Flipping
Player Missle Gr
Player Piano
Sounds
Vertical Scrolling

SILICA CLUB
Over 500 programs write for details

FOR FREE BROCHURES – TEL: 01-301 1111

For free brochures and reviews on our range of electronic products, please telephone 01-301 1111. To order by telephone, just quote your name, address, credit card number, and order requirements and leave the rest to us. Post and packing is FREE OF CHARGE in the UK. Expected final delivery available at all times.

- SHOP DEMONSTRATION FACILITIES — we provide full facilities at our shop at Sidcup. Monday to Saturday, 9am to 5.30pm. Wednesday, 9am - Friday 8pm.
- MAIL ORDER — we are a specialist mail order company and are able to keep stocks down to your benefit.
- MONEY BACK UNDERTAKING — if you are totally unsatisfied with your purchase, you may return it to us within 15 days. On request we will provide a telephonic credit or we will give you a full refund.
- PART EXCHANGE — we are Atari Dealers and can offer a part exchange scheme to trade in many makes of TV game for personal computers.
- COMPETITIVE PRICES — our prices, offers and service are very competitive. We are never knowingly undersold, and we normally match any lower price quoted by our competitors.
- HELPFUL ADVICE — available on the suitability of various computers.
- AFTER SALES SERVICE — available on all computers out of guarantee.
- VAT — all prices quoted above include VAT at 15%.
- CREDIT FACILITIES — we offer credit over 12, 24 or 36 months, please ask for details.

SILICA SHOP LIMITED
Dept. YC0183, 1-4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX. Telephone 01-301 1111 or 01-309 1111

SILICA SHOP

FREE LITERATURE

I am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochures and test reports as well as your price list covering all of the available Hardware and Software:

Name .....

Address .....

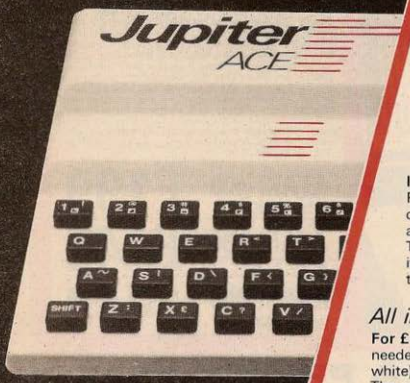
.....

.....

Postcode .....

YC0183 — Your Computer — January 1983

Jupiter ACE



The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

If you own a personal computer you will be aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled. The Jupiter Ace is your answer.

If you already know FORTH, the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

All inclusive price

For £89.95 you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual.
The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace.
Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming.
The price includes postage, packing and V.A.T.
The Jupiter Ace is backed by a full 12 month warranty.

"The Ace is an excellent way of using FORTH"

Popular Computing Weekly

"FORTH is an easy language"

Byte

Available soon

Plug-on parallel printer interface.
For around £20.00 this will connect your Jupiter Ace to anything from high-speed dot matrix to letter-quality daisy wheel printers.

Plug-on 16K Memory Expansion
For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving you instant access to enormous amounts of information.

Software
A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

FORTH Finishes First!

Speed Comparison Chart showing times in seconds to perform one thousand operations.

Type of Operation	Jupiter Ace	BBC Micro	Vic 20	Spectrum	ZX81
Empty loop	0.12	0.67	1.3	4.2	17.7
Print a number	7.5	13.5	26	19	430
Print a character	0.62	1.3	3.1	7.5	24
Add two numbers	0.45	1.4	5.5	7.5	28
Multiply two numbers	0.9	1.6	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

only £89.95

Designed by Jupiter Cantab

Computer Designers Steven Vickers and Richard Altwasser played a major role in creating the ZX Spectrum and then formed Jupiter Cantab to develop advanced ideas in personal computing. The Ace is the result, another all-British computer to lead the world.

Technical Information

Hardware
Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

Keyboard
40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen
Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii character set.

Graphics
Chunky graphics (64 x 46 pixels) may be plotted, unplotted or over-plotted (XOR operation). Also, the entire character set (128 characters and their video inverses) may be redefined allowing intricate shapes to be drawn with a resolution equivalent to 256 x 192 pixels.

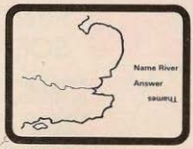
Control Structures
IF–ELSE–THEN, DO–LOOP DO–I–LOOP, BEGIN–WHILE–REPEAT, BEGIN–UNTIL, all may be mixed and nested to any depth.

Cassette
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

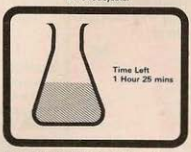
Expansion Port
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound
Internal loudspeaker may be programmed to operate over the entire audio spectrum.



In Schools Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.

At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.

Programming in FORTH

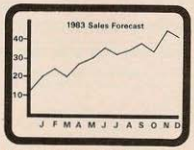
Programming in FORTH

FORTH programs are constructed without line-numbers, as words which are defined in terms of other words that already exist. Consider the following definition of the word **STARS**. Comments are in parenthesis and have no action.

```
: STARS          (: starts word definition)
  " *** "        (print 3 asterisks)
  200 100 BEEP   (play a note for
                  100 mSecs)
;
```

The semi colon at the end finishes the word definition. Now, whenever you say **STARS** the computer will print out 3 asterisks and sound a short tone. (Notice how the word **BEEP** comes after the numbers it uses, 200 and 100. This characteristic occurs throughout FORTH so that you write, for instance, 28 76 + instead of 28 + 76.)

The Jupiter Ace already has 140 FORTH words defined in ROM.



In the Office Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

The **Jupiter Ace** is available only by mail order. Please allow up to 28 days for delivery.
Send cheque or postal order with the form to:—
JUPITER CANTAB, 22 FOXHOLLOW, BAR HILL, CAMBRIDGE CB3 8EP

"FORTH is very flexible"

"FORTH is compact"

Electronics and computing

"FORTH is in general very much faster than BASIC"

Computing Today

ORDER NOW!

Please send me:—

☐ JUPITER ACE MICROCOMPUTER(S) @ £89.95.

Name. Mr/Mrs/Miss

Address

F

LET YOUR MICRO TAKE OFF WITH GEMINI

USING GEMINI FUNCTIONAL CASSETTE SOFTWARE FOR JUST £19.95

Fully compatible with

TI – 99/4A
VIC 16K
Oric
Dragon 32
SHARP MZ – 80K/A/B
BBC Micro
Sinclair Spectrum
ATARI 400/800

Here's the software to run your budgeting, your business, your stamp collection, your car costs . . . even to plan your next meal and help you choose a wife. Tested programs that come with all the documentation back-up you need from Gemini who are experts in practical software. So mail us the coupon – and put your micro to work . . . fast.

SPECIAL LIMITED OFFER
Any 3 programs at £19.95 for the price of two with all orders received before 31st March 1983.

DATABASE The Program that everyone needs. Facilities include sort, search, list, delete, change, totals, save file, line print if required, etc. etc. Can be used in place of any card index application. **£19.95**

STOCK CONTROL All the necessary for keeping a control of stock. Routines include stock set up, user reference no., minimum stock level, financial summary, line print records, quick stock summary, add stock, delete/change record and more. **£19.95**

MAILING LIST A superb dedicated database to allow for manipulation of names & addresses & other data, with selective printing to line printer. Features include the facility to find a name or detail when only part of that detail is known. Will print labels in a variety of user-specified formats. **£19.95**

INVOICES AND STATEMENTS Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations including VAT automatic and provision for your own messages on the form produced. *Not Spectrum **£19.95**

COMMERCIAL ACCOUNTS A gem of a program, all for cassette, with the following features:–
Daily Journal • Credit Sales • Cash Sales • Credit Purchases • Purchases – other • Sales Ledger • Purchase Ledger • Bank Account • Year to Date Summary
A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance. **£19.95**

HOME ACCOUNTS Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account, mortgage, H.P. etc. etc. etc! You'll wonder how you ever managed without it. **£19.95**

Gemini Marketing Limited.
Functional Software Specialists
9, Salterton Road Exmouth, Devon.
Telephone orders welcome. (03952) 5832
Please quote Access/Diners Card Number

For Functional Software

Dealer Enquiries Welcome

ZX81 16K – Database available – Only £7.50 including FREE Decision Maker Programme.

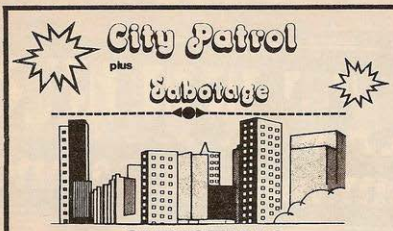
GEMINI MARKETING LIMITED

Tick the box for Program you require. Prices include V.A.T and Package and Postage.
Please supply the following cassette software.

Database	£19.95	☐
Stock Control	£19.95	☐
Mailing List	£19.95	☐
Invoices and Statements	£19.95	☐
Commercial Accounts	£19.95	☐
Home Accounts	£19.95	☐
ZX81 16K Database	£7.50	☐

Name _____
Address _____
Machine Type _____ Memory Size _____
I enclose _____
Make cheques and postal orders payable to Gemini Marketing Ltd. All orders despatched within 7 days.
Diners Card Number _____ Access Number _____
Signature: _____

Gemini. Functional Software Specialists 9, Salterton Road, Exmouth, Devon. (03952) 5832
Telephone orders welcome. Please quote Access/Diners Card Number



CHRISTMAS SPECIAL OFFERS

ZX81 CASSETTE 1 CITY

2 superb original games written in machine code for 16K memory.

The Graphics of CITY PATROL can only be described as fantastic — your task is to protect your city against Aliens who are Hell-Bent on total destruction. The full screen displays only a portion of the City at any one time and requires you to patrol between street level and skyline, either at touring speed or at racing speed in either direction around the City. Track the alien and destroy him.

SABOTAGE is a game of strategy requiring fast decision making. Two different games in one — you can play the role of either Sabator or God. Superb value at only . . . **£5.95**

CASSETTE 2 ZAC-MAN

A 9 Speed arcade type game, written in Machine Code with excellent graphics **£3.95**

SPECTRUM — Bumper Games offer (until 31st December only)

Five 16K Games with sound and colour for only **£9.95**. Normally sold individually at a total value of over **£20**.

BUMPER INCLUDES — Dragon Maze, Nightmare Park, Space Rescue, Star Guest, Blok. Lots of other ZX Software — SEND SAE FOR CATALOGUE. CHEQUES OR POSTAL ORDERS TO:

MACRONICS SYSTEMS LIMITED

26 Spiers Close, Knowle, Solihull B93 9ES

Buy it with Access

BARCLAYCARD VISA

SOUND with ZX-81!

MAKE AMAZING SOUND EFFECTS WITH YOUR ZX-81

£25.95 incl p&p & V.A.T.

THE ZON X-81

* The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in — no dismantling or soldering.
* No power pack, batteries, leads or other extras.
* Manual Volume Control on panel — ample volume from built-in loudspeaker.
* Standard ZX-81 — 16K Rampack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
* Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords etc., or whatever you devise!
* Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
* Easily added to existing games or programmes using a few simple "BASIC" lines.

FULL instructions with many examples of how to obtain effects and the programmes, supplied. Fully Guaranteed.

BI-PAK Dept. YC ⊕ P.O. Box 6 63A High Street, Ware, Herts.

BARCLAY Buy it with Access VISA

Access & VISA accepted Ring 0920 3182 for immediate despatch

SUPER QUALITY SOFTWARE FROM LLAMASOFT!!
(DESIGNER — JEFF MINTER)

VIC 20

ABDUCTOR NEW J

GRID RUNNER NEW J

ANDES ATTACT (8K, REPLACES DEFENDA) NEW J
Your spacecraft must attack the descending aliens and frustrate their evil intent. The game includes swarmers, baiters, pods, landers, bombers, mutants, humanoids and smart bombs. Machine code high resolution colour graphics. Uses joystick controls and requires an 8K or larger expansion. **Only £8.00 + 50p P&P includes full documentation.**

TRAXX M/C (8K EXPANSION) J
This is a VIC 20 cross breed between the now famed 'Packman' and the game 'Quix'. All in machine code, fast and fun with joystick controls, uses Hi-Res colour graphics. 8K or larger expansion needed. **Only £6.00 + 50p P&P complete with instructions.**

RATMAN! (8K EXPANSION)
Another amazing game from Llamasoft!! You are the man under attack by the deadly rats as they fall from the sky. You must dodge the arrows to get to the rats and then squash them with your hammer before they dig under the platform on which you stand, and mutate into devils. Fast action with great graphics to make an extremely addictive game 8K or larger memory expansion needed. Hi-Res colour graphics, in machine code. **Only £5.00 + 50p P&P complete with instructions.**

BREAKOUT/DELEX (UNEXP VIC)
Unexpanded package a full feature version of the popular arcade Breakout plus a new concept in computer games, Deflex!! Both programs on one cassette **only £3.95.**

BLITZKRIEG (UNEXP VIC)
As seen at the Commodore show and reviewed by the Daily Telegraph. Fly your Vulcan Bomber over the enemy city and destroy the buildings. 25 levels of play, uses Hi-Res colour graphics and plays Rule Britannia between waves. **Only £4.95 complete with instructions.**

GAME GRAPHICS EDITOR/SOFTKEY (ALL VIC)
Create your very own custom characters for the unexpanded VIC 20, up to 64 characters with facilities such as reflect and save on cassette etc.

SOFTKEY 24
This program, designed to run on the VIC 20 with any memory size gives you the facility of 24 key words on your function keys. Key words include peek, poke, run, save, list, for next etc. Both programs on one cassette **only £6.00 + P&P with full documentation.**

SPECTRUM

GRAPHICS CREATOR (16K)
NOT just another character editor! Allows you to define not only the 21 user definable characters. Also allows you to change the entire 96 character ASCII set. Creates BYTES files ready for you to load into your own programs. Includes advanced Reflect, Invert, Field commands etc. Complete with full documentation. If BIN the BIN statement and use Graphics Creator with its easy on-screen cursor editing. **£2.95 + 50p P&P.**

BOMBER (16K)
Yes, a full feature version of the popular game 'Blitz', supplied for the 16K or 48K Spectrum. **For only £2.95 + 50p P&P.**

ROX III (16K)
Blast the falling meteors as they invade your planet, cruise missiles are your only defence in this world of disaster. If they break through the crust of your planet then your life support systems will fail. An addictive game with fast action and great graphics. 16K or 48K Spectrum **only £2.95 + 50p P&P.**

SUPERDEFLEX (48K)
Bounce "Sid", the space invader, around the screen into the power pods, keeping away of course from the devil who chases you around the screen. Steer with your Deflex shields, but beware the mines or your may be buried alive! Superb graphics and fantastic sound on the 48K Spectrum only. **Only £4.95 on cassette + 50p P&P.**

ATARI 400-800

TURBOXFLEX
Superb ultra-fast and totally new ball game. Uses ATARI's unique features to the full. Incorporates superb colour/sound effects and uses Player Missile graphics. Tables top 10 scores along with Scorer's name. **£6.00 + 50p P&P.**

GRAPHICS/CHARACTER CREATOR
Now you can define your own custom character sets, or edit existing sets. Results are fully displayed on screen in modes 0, 1, 2. Special features include reflect, invert, save character sets etc. Supplied on cassette with data sheet **only £8.00 + 50p P&P.**

ZX81

CENTIPEDE (16K)
The ORIGINAL game from the ORIGINAL author. This is the identical program to that being sold by other companies for three times our price. The game has received ecstatic reviews in the computing press. Program has 30 speed levels and ever increasing Centipede hordes. Table top 10 scores and names. Why wait to pay more? **Only £1.95 + 50p P&P.**

J = JOYSTICK CONTROL

LLAMASOFT SOFTWARE

Dept. YC4
49 Mount Pleasant
Tadley, Hants
RG26 6BN.
Tel: 07356-4478
Trade enquiries welcome.

Please add 50p P&P with all orders

INTEREST FREE

On Atari, VIC 20, Commodore 64 and

If your order contains over £120 worth of computer hardware apply now for interest free credit by telephoning: Mail-order: (0702) 552911. London Shop: 01-748 0926. Birmingham Shop: 021-356 7292. Southend Shop: 0702 554000 or write to P.O. Box 3, Rayleigh, Essex SS6 8LR.

You pay 10% down, then 10% per month for a further nine months (to nearest penny). Example: VIC20 Colour Computer. Cash Price £169.99. Credit terms: £16.99 down then £17 per month for nine months: Total £169.99. Credit quotations on request.

THE NEW COMMODORE 64

The incredible new computer from Commodore comes with 64K RAM fitted! Plus 16 colours, hi-res graphics, 320 x 200 pixels, 40 columns by 25 lines, Z80 micro processor can be added — that means you can run CP/M software, 8 independently movable Sprites with collision detection, and a sound generator with 3 voices, 4 waveforms, envelope and filter to rival some dedicated music synthesisers. And all this at the most incredible price ever.

(AF56L) Only £339.00

DRAGON 32

The amazing new British computer with a full-travel standard keyboard, a 16-bit microprocessor, 32K RAM fitted (expandable to 64K and later to 256K!!), 9 colours, hi-res graphics and Microsoft extended colour BASIC (the very best BASIC to learn with). It can be used with virtually any ordinary cassette recorder, it has a printer interface (Centronics-type), joysticks are available and it's incredible value for money. **(AF57M) Only £199.50**

THE AMAZING ATARI COMPUTERS

4 Consoles Available:

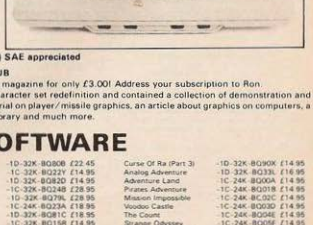
Atari 400 with 16K RAM (AF36P) £249.95

Atari 400 with 48K RAM (AF37S) £319.00

Atari 800 with 16K RAM (AF02C) £399.00

Atari 800 with 48K RAM (AF55K) £490.00

*** All above with BASIC & handbooks**



Other hardware:		
Cassette Recorder	(AF28F)	£50.00
Disk Drive	(AF06G)	£299.95
Thermal Printer	(AF04E)	£265.00
Epson MX80T Mk III	(AF38R)	£399.95
Epson MX80F/T Mk III	(AF40T)	£447.35
Printer Interface for 400	(AF41U)	£59.95
Printer Interface for 800	(AF42V)	£59.95
Interface Module	(AF29G)	£135.00
Versawriter	(AF43W)	£199.95
16K RAM Module	(AF08J)	£55.00
48K RAM Module for 400	(AF44X)	£125.35
48K Upgrade for 400	(AF45Y)	£75.00
Floppy Disk	(YX87U)	£2.50
Le Stick	(AC45Y)	£24.95
Joystick Controllers (Pair)	(AC37S)	£13.95
Paddle Controllers (Pair)	(AC30H)	£13.95

For full details ask for our hardware leaflet (XH54J) SAE appreciated

JOIN THE U.K. ATARI COMPUTER OWNERS' CLUB

An independent users' group. Four issues of the club magazine for only £3.00! Address your subscription to Ron. issue 1 of the club magazine featured a tutorial on character set redefinition and contained a collection of demonstration and games programs and lots more. Issue 2 featured a tutorial on player/missile graphics, an article about graphics on computers, a selection of members' contributions to the program library and much more.

THE FINEST SELECTION OF ATARI SOFTWARE

Teach-Yourself Programs

Conversational French	-5C-16K-YG44X £39.95
Conversational German	-5C-16K-YG45Y £39.95
Conversational Spanish	-5C-16K-YG46A £39.95
Conversational Italian	-5C-16K-YG47B £39.95
Touch Typing	-2C-16K-YG49D £15.95
States & Capitals	-1C-16K-YG56L £9.95
Euro Countries & Capitals	-1C-16K-YG57M £9.95
Kids 1 (3 Programs)	-1C-16K-BG00A £9.95
Kids 1 (3 Programs)	-1D-24K-BG01B £9.95
Kids 2 (3 Programs)	-1C-16K-BG02C £9.95
Kids 2 (3 Programs)	-1D-24K-BG03D £9.95

Learn Programming

Invitation To Programming 1	-1C-8K-YG43W £15.95
Invitation To Programming 2	-2C-8K-BG67X £22.95
Invitation To Programming 3	-2C-8K-BG68Y £22.95
Basics Of Animation	-1C-16K-BG57M £11.95
Basics Of Animation	-1D-24K-BG58N £11.95
Player Missile Graphics	-1C-32K-BG59P £18.95
Player Missile Graphics	-1D-32K-BG60Q £18.95
Display Lists	-1C-16K-BG61T £11.95
Display Lists	-1D-24K-BG62U £11.95
Horiz./Vert. Scrolling	-1C-16K-BG53H £11.95
Horiz./Vert. Scrolling	-1D-24K-BG54J £11.95
Page Flipping	-1C-16K-BG55K £11.95
Page Flipping	-1D-24K-BG56L £11.95
Sounds & Music	-1C-16K-BG04E £11.95
Sounds & Music	-1D-24K-BG05F £11.95
Tricky Tutorials	-3C-32K-BG06G £59.95
Tricky Tutorials	-3D-32K-BG07H £59.95

Business Programs

Visicalc	-1D-32K-YL39N £119.95
Atari Word Processor	1C&3D-48K-YG42V £99.95
Text Wizard	-1D-32K-BG99H £69.95
Mini Word Processor	-1C-32K-BG08J £11.95
Mini Word Processor	-1D-32K-BG09K £11.95
Calculator	-1D-24K-YG50E £16.95
Graph-it	-2C-16K-YG51F £13.95
Statistics	-1C-16K-YG52G £13.95
Personal Financial Management	
	-3D-32K-BG65V £49.00
Mortgage & Loan Analysis	-1C-16K-BG66W £13.95
Bob's Business	-1C-32K-BG11M £9.95
Bob's Business	-1D-32K-BG12N £9.95

Adventure Games

Galactic Empire	-1C-32K-BG14Q £14.95
Rescue At Rigel	-1C-32K-BG21X £22.45
Rescue At Rigel	-1D-32K-BG80B £22.45
Dateabases Of Ryn	-1C-32K-BG22Y £14.95
Dateabases Of Ryn	-1D-32K-BG82D £14.95
Star Warrior	-1C-32K-BG24B £28.95
Star Warrior	-1D-32K-BG79L £28.95
Invasion Orion	-1C-24K-BG23A £18.95
Invasion Orion	-1D-32K-BG81C £18.95
Star Trek 3.5	-1C-32K-BG15R £14.95
Star Trek 3.5	-1D-40K-BG26D £18.95
Crush, Crumble & Chomp	-1C-32K-BG83E £22.45
Crush, Crumble & Chomp	-1D-32K-BG84F £22.45
Mission: Asteroid	-1D-40K-BG91Y £17.19
Wizard & The Princess	-1D-40K-BG25C £21.78
Ulysses & The Golden Fleece	
	-2D-40K-BG92A £20.64
Zork I	-1D-32K-BG94C £29.95
Zork II	-1D-32K-BG95D £29.95
Ali Baba & The 40 Thieves	-1D-32K-BG78K £27.95
Temple Of Apshai (Part 1)	-1D-32K-BG85G £28.95
Temple Of Apshai (Part 1)	-1D-32K-BG86T £28.95
Upper Reaches Of Apshai (Part 2)	
	-1C-32K-BG87U £14.95
Upper Reaches Of Apshai (Part 2)	
	-1D-32K-BG88V £14.95
Curse Of Ra (Part 3)	-1C-32K-BG89W £14.95
Curse Of Ra (Part 3)	-1D-32K-BG90X £14.95
Analog Adventure	-1D-32K-BG33L £16.95
Adventure Land	-1C-24K-BG00A £14.95
Pirates Adventure	-1C-24K-BG01B £14.95
Mission Impossible	-1C-24K-BG02C £14.95
Voodoo Castle	-1C-24K-BG03D £14.95
The Count	-1C-24K-BG04E £14.95
Strange Odyssey	-1C-24K-BG05F £14.95
Mystery Fun House	-1C-24K-BG06G £14.95
Pyramid Of Doom	-1C-24K-BG07H £14.95
Ghost Town	-1C-24K-BG08J £14.95
Savage Island I	-1C-24K-BG09K £14.95
Savage Island II	-1C-24K-BG10L £14.95
Golden Voyage	-1C-24K-BG11M £14.95
Softporn Adventure	-1D-40K-BG93B £20.64
Deadline	-2D-32K-BG96E £34.95
The Shattered Alliance	-1D-48K-BG98G £29.95
The Battle Of Shiloh	-1C-40K-BG63T £29.95
The Battle Of Shiloh	-1D-40K-BG97F £29.95
Energy Czar	-1C-16K-YG53H £9.95
Kingdom	-1C-8K-YG55K £9.95
Space Shuttle Module 1	-1D-32K-BG66V £19.95

Arcade Games

Star Raiders	-1E-8K-YG66W £29.95

ATARI SOFTWARE continued

Asteroids	-1E-8K-YG60Q £29.95
Space Invaders	-1E-8K-YG70M £29.95
Missile Command	-1E-8K-YG64U £29.95
Caverns of Mars	-1D-16K-BQ69A £24.50
K-Razy Shoot Out	-1E-8K-BQ67E £29.95
K-Razy Kritters	-1E-8K-BQ51F £29.95
K Star Patrol	-1E-8K-BQ53G £29.95
Pathfinder	-1D-32K-BQ33L £27.95
Crossfire	-1C-16K-BQ22Y £20.64
Crossfire	-1D-32K-BQ23A £20.64
Protector	-1C-32K-BQ24B £21.80
Protector	-1D-32K-BQ25C £21.80
Threshold	-1D-40K-BQ18U £27.54
Deluxe Invaders	-1D-16K-BQ34M £29.95
Galactic Chase	-1C-16K-BQ62S £16.95
Galactic Chase	-1D-16K-BQ61R £19.95
Race In Space	-1C-16K-BQ35Q £14.95
Race In Space	-1D-16K-BQ20W £16.95
Space Chase	-1C-16K-BQ42V £10.95
Space Chase	-1D-24K-BQ43W £12.95
Centipede	-1E-16K-BQ70M £29.95
Angle Worms	-1C-8K-BQ50E £10.95
Lunar Lander	-1C-24K-BQ16E £10.95
Lunar Lander	-1D-24K-BQ49D £14.95
Jumbo Jet Lander	Available November
Submarine Commander	Available November
Rasterblaster	-1D-32K-BQ36Q £22.95
Shooting Gallery	-1C-16K-BQ36P £14.95
Shooting Gallery	-1D-16K-BQ19V £16.95
Shooting Arcade	-1C-16K-BQ15R £24.95
Shooting Arcade	-1D-16K-BQ16S £24.95
Super Breakout	-1E-8K-YG67X £24.50
Dodge Racer	-1C-16K-BQ29G £19.95
Dodge Racer	-1D-24K-BQ30H £19.95
Matchracer	-1C-16K-BQ31J £23.95
Matchracer	-1D-16K-BQ32K £23.95
Moulsatack	-1D-32K-BQ77J £22.95
Jawbreaker	-1C-16K-BQ17T £20.64
Jawbreaker	-1D-32K-BQ26D £20.64
Ghost Hunter	-1C-16K-BQ64U £19.95
Pac-Man	-1E-8K-BQ71N £29.95
Pacific Coast Highway	-1C-16K-BQ13P £24.95
Pacific Coast Highway	-1D-16K-BQ14Q £24.95
Chicken	-1C-16K-BQ27E £21.80
Chicken	-1D-16K-BQ28F £21.80
Tumble Bugs	-1D-24K-BQ46A £24.95
Bug Attack	-1C-24K-BQ36P £23.95
Bug Attack	-1D-40K-BQ37S £23.95
Canyon Climber	-1C-16K-BQ44X £24.95
Canyon Climber	-1D-16K-BQ45Y £24.95
Mountain Shoot	-1C-16K-BQ12N £10.95
Haunted Hill	-1C-16K-BQ38R £16.95
Haunted Hill	-1D-16K-BQ39N £19.95
Time Bomb	-1C-16K-BQ40T £10.95
Time Bomb	-1D-24K-BQ41U £12.95
Tank Trap	-1C-16K-YL34M £9.95
Tank Trap	-1D-32K-YL35Q £12.95
Thunder Island	-1C-16K-BQ37S £10.95

Home Game Programs

Scram	-1C-16-24K-YG58N £17.50
Basketball	-1E-8K-YG61R £24.50
Cypher Bowl	-1C-16K-BQ20W £28.50
Sunday Golf	-1C-16K-BQ13P £10.95
Darts	-1C-16K-BQ42V £19.95
Tournament & 8-Ball Pool	-1C-16K-BQ46Y £19.95
Snooker & Billiards	-1C-16K-BQ44X £19.95
Ricochet	-1C-16K-BQ47B £14.95
Ricochet	-1D-32K-BQ48C £14.95
Computer Chess	-1E-8K-YG63T £24.50
Fast Gammon	-1C-8K-YL33L £16.95
Gomoku	-1C-16K-BQ18U £14.95
Gomoku	-1D-16K-BQ55K £19.95
Reversi	-1C-16K-BQ19V £14.95
Reversi	-1D-16K-BQ56L £19.95
Cribbage & Dominoes	-1C-16K-BQ43W £14.95
Poker Solitaire	-1C-16K-BQ17T £10.95
Poker Solitaire	-1D-16K-BQ53H £14.95

Blackjack	-1C-8K-YG62S £9.95
Hangman	-1C-8K-YG54J £9.95
Super Cubes & Tilt	-1C-16K-BQ48C £14.95
Humpty Dumpty & Jack & Jill	
Hickory Dickory Dock & Baa Baa Black Sheep	-1C-16K-BQ39N £19.95
British Heritage Jigsaw Puzzles	-2C-16K-BQ41U £19.95
European Scene Jigsaw Puzzles	-2C-16K-BQ40T £19.95
Video Easel	-1E-8K-BQ72F £24.50
Micro Painter	-1D-48K-BG56L £29.95

Music Programs

Music Composer	-1E-8K-YG68C £35.95
Movie Themes	-1C-8K-BQ34M £9.95

Computer Languages

Assembler	-1C-16K-YL32K £19.95
Assembler Editor	-1E-8K-YG68Y £39.95
Macro Assembler	-1D-32K-BQ73Q £59.95
Basic A+	-1D-48K-BQ31J £49.95
Basic A+ & Operating System A+	-1D-48K-BQ32K £99.50
Microsoft Basic	-1D-32K-BQ74R £59.95
Pilot (Educator)	-1E & 2C-16K-BQ75S £79.95
Pilot (Consumer)	-1E-8K-YG69A £54.00
QS Forth	-1D-24K-YL29G £49.95
Tiny-C	-1D-48K-BG62S £64.95
Inter-Lisp/65	-1D-48K-BG61R £87.00

Utilities

Programming Aids Package 1	-1C-16K-BG60Q £ 9.95
6502 Disassembler	-1C-8K-YL30H £9.95
6502 Disassembler	-1D-8K-YL31J £12.95
Atari World	-1D-40K-BQ27E £43.95
3D Supergraphics	-1C-40K-BQ29G £29.95
3D Supergraphics	-1D-40K-BQ28F £29.95
File It 2	-1D-48K-BG10L £34.95
Filemanager 800	-1D-40K-BG59P £72.80
K-DOS	-1D-32K-BQ76H £49.95
Disk Manager	-1D-32K-BG58N £21.80
Disk Detective	-1D-16K-BG57M £24.95
Operating System A+	-1D-32K-BQ30H £49.95
Telelink	-1E-8K-YG59P £21.50
The Next Step	-1D-32K-BG64U £27.54

Books

Master Memory Map	-XH57M £4.00
De Re Atari	-WG56L £16.95
Operating System User's Manual & Hardware Manual	-WA46A £16.95
Atari Basic-Learning By Using	-WG55K £5.24
Games For The Atari	-WA47B £4.46
Atari Basic	-WG05F £6.80
Atari Sound & Graphics	-WA39N £8.25
Your Atari Computer	-WA40T £13.45
6502 Assembly Language Subroutines	-WA05F £12.45
Advanced 6502 Interfacing	-WA41U £11.45
Beyond Games (6502)	-WA45Y £13.00
Computers For People	-WA00A £8.25
Analog, The Magazine For Atari (6 issues) Annual Subscription	-GG24B £9.00

Send sae now for our new software leaflet with details of all the above programs.

Order As XHS2G — Issue 3.

Key: C = Cassette. D = Disk. E = Cartridge.
2C = 2 Cassettes etc 8K, 16K shows minimum memory requirement.

Note: Order codes shown in brackets. Prices correct at time of going to press. (Errors excluded).

VIC20 COLOUR COMPUTER

Hardware

VIC20 Console	(AF478) £169.99
C2N Cassette Unit	(AF48C) £44.95
VIC Printer	(AF49D) £230.00
VIC Disk Drive	(AF50K) £396.00
3K RAM Cartridge	(AF51F) £29.95
8K RAM Cartridge	(AF52G) £44.95
16k RAM Cartridge	(AF53H) £74.95

Joysticks and Paddles

Single Joystick	(AC52H) £7.50
Pair of Joysticks	(AC37B) £13.95
Le Stick	(AC45Y) £24.95
Pair of Paddles	(AC30H) £13.95

Programming Aid Cartridges

Super Expander: 3K RAM and Hi-res graphics	(AC54J) £34.95
Programming Aid: Additional commands, function Key programming etc	(AC55K) £34.95
Machine Code Monitor	(AC56L) £34.95

Software (all 3K unless stated)

Introduction to BASIC Cassettes

Part 1	(AC57M) £14.95
Part 2	(AC58N) £14.95

Game Programs

Avenger: Cartridge	(AC59P) £19.95
Star Battle Cartridge	(AC60Q) £19.95
Super Slot Cartridge	(AC61R) £19.95
Jelly Monsters Cartridge	(AC62S) £19.95
Alien Cartridge	(AC63T) £19.95
Super Lander Cartridge	(AC64U) £19.95
Road Race Cartridge	(AC65V) £19.95
Rat Race Cartridge	(AC66W) £19.95
Blitz Cassette	(AC67X) £4.99
Mole Attack Cartridge	(AC85G) £24.95
Adventureland Cartridge	(AC86T) £24.95
Pirate Cove Cartridge	(AC84F) £24.95
Mission Impossible Cartridge	(AC87U) £24.95
Voodoo Castle Cartridge	(AC88V) £24.95
The Count Cartridge	(AC89W) £24.95
Sargon 2 Chess Cartridge	(AC77J) £24.95
Gorf Cartridge	(AC90X) £24.95
Omega Race Cartridge	(AC91Y) £24.95
Another VIC in The Wall Cassette	(AC78K) £7.00
VIC Panic Cassette	(AC79L) £7.00
Cosmiads Cassette	(AC80B) £7.00
Backgammon Cassette (+3K)	(AC81C) £7.00
VIC Men Cassette	(AC82D) £7.00
VIC Asteroids Cassette	(AC83E) £7.00

Business Programs

Simplicalc Disk (+16K)	(AC92A) £24.95
Simplicalc Cassette (+16K)	(AC93B) £19.95
VIC Stock Control Cassette (+8K)	(AC94C) £19.95
VIC File Disk (+16K)	(AC95D) £24.95
VIC Writer Disk (+8K)	(AC96E) £24.95
VIC Writer Cassette (+8K)	(AC97F) £19.95

Education (CSE & GCE 'O' Level Revision) All cassette based and require at least 8K expansion memory.

English Language	(AC98G) £9.99
Mathematics 1	(AC99H) £9.99
Mathematics 2	(BC00A) £9.99
Biology	(BC01B) £9.99
Chemistry	(BC02C) £9.99
Physics	(BC03D) £9.99
Computer Studies	(BC04E) £9.99
Geography	(BC05F) £9.99
History	(BC06G) £9.99
Arithmetic for 9 to 11 year olds	(BC07H) £9.99
Reading for 9 to 11 year olds	(BC08J) £9.99
General Knowledge for 9 to 11 year olds	(BC09K) £9.99
Spelling for 9 to 11 year olds	(BC10L) £9.99

Home Programs

All cassette based and require at least 8K expansion memory.

Quizmaster	(BC11M) £9.99
Know Your Own IQ	(BC12N) £9.99
Junior IQ	(BC13P) £9.99
Know Your Own Personality	(BC14Q) £9.99
The Robert Carnet Family Menu Planner	(BC15R) £9.99
VIC Money Manager	(BC16S) £9.99
VIC Road User & Highway Code	(BC17T) £9.99
Garden Planner	(BC18U) £9.99
Interior Designer	(BC19V) £9.99
BBC 'Ask The Family'	(BC20W) £9.99
BBC 'Mastermind'	(BC21X) £9.99
'Mastermind' additional General Knowledge	
Data 1	(BC22Y) £2.50
Data 2	(BC23A) £2.50
Data 3	(BC24B) £2.50
Data 4	(BC25C) £2.50
'Mastermind' additional Specialist Knowledge	
Wine & Food	(BC26D) £2.50
Music	(BC27E) £2.50
Sport & Games	(BC28F) £2.50
Films & TV	(BC29G) £2.50

Books About VIC

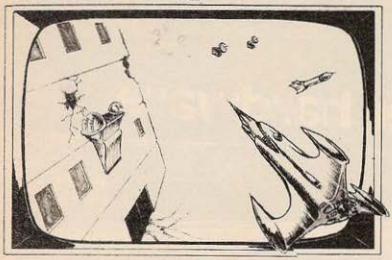
Learn Programming on the VIC	(WA31J) £2.50
VIC Revealed	(WA32K) £10.00
VIC Programmers Reference Guide	(WA33L) £9.95
VIC Graphics	(WA48C) £10.00

MAPLIN

Maplin Electronic Supplies Ltd., P.O. Box 3, Rayleigh, Essex. Tel: Southend (0702) 552911/554155.

Demonstrations at our shops NOW. See the computers in action at 159-161 King St., Hammersmith W6. Tel: 01-748 0926
284 London Road, Westcliff-on-Sea, Essex. Tel: (0702) 554000
Lynton Square, Perry Barr, Birmingham: Tel: (021) 356 7292.

Tonight On Your Micro



CAN YOU SURVIVE PENETRATOR?

Penetrator is the most amazing and sophisticated arcade game yet devised for the 48K Spectrum with features never seen before! Cassette £6.95.

RESCUE A VIC PRINCESS

A multi-part adventure for the standard VIC 20! All you have to do is find the castle, defeat the dragon, find your way through the labyrinth, kill the wizard and rescue the Princess. And that's not half of it! The Wizard & The Princess cassette only £5.95.

CONVERT YOUR VIC INTO AN ARCADE MACHINE

Amazing arcade action for the standard VIC 20 with 5 new exciting games from Clifford Ramshaw: ALIEN BLITZ*, INVADERS*, GROUND ATTACK, STORM and SPACE ROCKS* (games marked * contain machine code). You must have the GAMES PACK cassette - only $5.95.

TALK TO THE SPECTRUM!

Why is this man smiling? You will too when you read Dr. Logan's book UNDERSTANDING YOUR SPECTRUM. The definitive guide for only £7.95.

MELBOURNE HOUSE PUBLISHERS

Orders to: 131 Trafalgar Road, Greenwich, London SE10

Correspondence to: Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA

YC1

☐ Please send me your free catalogue.

Please send me:

Cassettes

16K SPECTRUM

- ☐ Over The Spectrum No. 1 £5.95
- ☐ Over The Spectrum No. 2 £5.95
- ☐ Over The Spectrum No. 3 £5.95
- ☐ Programs from Spectrum Machine Language Book £5.95

48K SPECTRUM

- ☐ Penetrator £6.95
- ☐ The Hobbit £14.95

STANDARD VIC 20

- ☐ VIC Innovative Cassette 1 £5.95
- ☐ VIC Innovative Cassette 2 £5.95
- ☐ VIC Innovative Cassette 3 £5.95
- ☐ VIC Games Pack £5.95
- ☐ The Wizard & The Princess £5.95

Books

SPECTRUM

- ☐ Understanding Your Spectrum £7.95
- ☐ Spectrum Machine Language For The Absolute Beginner £6.95
- ☐ Over The Spectrum £6.95

VIC 20

- ☐ VIC Innovative Computing £6.95

All prices include VAT where applicable

£ _____

Please add 80p for post and pack £ .80

TOTAL £ _____

Unconditional Guarantee All Melbourne House cassette software is supplied on high quality cassettes with attractive inserts. Full instructions are provided and the cassettes are unconditionally guaranteed against malfunction.

I enclose my cheque/money order for £ _____

Please debit my Access card No. _____ Expiry date _____

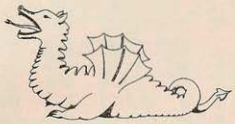
Signature _____ Name _____

Address _____

Postcode _____

MELBOURNE HOUSE PUBLISHERS

THE DRAGON GOES FORTH



FORTH FOR THE DRAGON 32

DRAGONFORTH is here! JADE COMPUTERS are proud to announce the first implementation of Forth for the excellent Dragon 32 computer. This version of Fig-Forth written by Oasis Software of Weston-Super-Mare provides the following great benefits for the Dragon programmer –

(1) A high level language that operates up to 30 times faster than Basic — now you can write your own fast moving games software without resorting to machine code.
(2) Define your own Forth wordsw from the dictionary of words provided.
(3) Access to basic commands from Forth — hence a Forth 'word' may be defined as a basic command — making it easy to draw those complex graphic character in basic — and then manipulate them at high speed from Forth.
(4) A full 50 page manual — explaining clearly how you can use Forth for your own programming.
(5) Coming soon! Some great action packed games written in Forth.

All this for just £18-95 (VAT. inc.)

Available from Jade Computers, Oasis Software, and all good Dragon dealers. (Dealer enquiries welcome)

OTHER NEW PRODUCTS FOR YOUR DRAGON

TANDY 4 COLOUR GRAPHIC PRINTER

This excellent new printer from the TRS 80 range enables text and graphics to be printed out from your Dragon or TRS 80 Computer. (Please enquire if you wish to link to any other computer).

High quality text may be output with either 40 or 80 characters/line at 12 charater/sec.
Uses standard 4½" wide plain paper. Serial and parallel interfaces . . . . .

Only £149

XAUIERSINE HIRES PLANNER PAD

Draw your own high resolution designs for the Dragon — then transfer them to your screen!
All 'print at' and 'plot' positions clearly marked.

Only £2.50 Each

jade GIVES YOU MORE

SEND YOUR ORDER ON THIS FORM TODAY!
(Telephone orders welcome on Access and Barclaycard.)

Send to: **JADE COMPUTERS LTD, FREEPOST, COOMBEND, RADSTOCK, BATH BA3 3GA**

NAME .....

ADDRESS .....

.....

PLEASE SEND ME:

..... DRAGON 32 MICROCOMPUTERS £195 + 4.50 POSTAGE

..... COLOUR PRINTERS £149 + £2.50 POSTAGE

..... HIRES PLANNERS £12.50 + 70p POSTAGE

..... FORTH LANGUAGE PACKAGE + MANUAL £18.95 + £1.50 POSTAGE

WIDE RANGE OF OTHER SOFTWARE AND ADD-ONS AVAILABLE PLEASE WRITE OR PHONE FOR PRICE LIST

I ENCLOSE CHEQUE/ POSTAL ORDER No. ..... FOR TOTAL £.....

OR PLEASE BILL MY ACCESS/ BARCLAYCARD ACCOUNT No. .....

SILVERSOFT

SPECTRUM — ZX81

NEW!

STARSHIP ENTERPRISE

Soar through the stars as a starship commander in this exciting new space ship simulation. This new, advanced version of Startrek uses the full colour graphics and sound facilities of modern micros. Full 3D — Klingon attacks, graphic hyper-warp, plus all the normal 'Startrek' features and a whole lot more, add up to one of the best games in the galaxy!!

48K Spectrum £5.95.

ORBITER

Fast and furious action is what you get in this amazing Defender-style program for the ZX-Spectrum.

ORBITER is written entirely in m/c code and has full arcade features, including scanners, reverse, hyper-space, continuous scoring and sound effects, plus humanoids, landers, mutants and all the other alien nasties. 16K or 48K Spectrum £5.95.

GROUND ATTACK

Survival is the name of the game in this exciting Scramble-type arcade game for the ZX-Spectrum.

Your mission is to pilot your spaceship through tortureous caverns while destroying the enemy missile launchers and fuel dumps.

GROUND ATTACK is written completely in machine code. And has full arcade features including lasers, bombs, explosions, continuous scoring and sound effects, plus rockets, fuel dumps and airborne aliens. 16K or 48K Spectrum £5.95.

Any hiring, lending or copying (except backup) of Silversoft software is strictly forbidden without written permission from Silversoft.

GENEROUS DEALER DISCOUNTS AVAILABLE

Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.

NEW! ZX81-COMPILER

Yes! Now you can write machine code on your ZX81. No more messing about with assemblers and disassemblers simply type in the BASIC program and the machine does the rest. ONLY £5.95.

ZX81 ARCADE ACTION (New low prices)

MUNCHER Exciting pacman game for the ZX81	**£4.95**
ASTEROIDS "Just the thing for asteroid addicts"	**£4.95**
INVADERS "Probably the best version of INVADERS"	**£3.95**
ALIEN-DROPOUT Exciting ORIGINAL arcade game	**£3.95**
STARTREK YES! you can be a starship commander	**£3.95**
GRAPHIC GOLF 18 graphically displayed holes	**£3.95**
SUPERWUMPUS An underground adventure	**£3.95**
GAMES PACK 1 Fantastic value for money, nearly 50K of programs on one cassette! Only	**£3.95**

Please send me _____

I enclose a cheque/PO for £ _____

Name _____

Address _____

_____

_____

Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.

SILVERSOFT

BBC MICRO SOFTWARE

NEW!

NEW!

STARSHIP ENTERPRISE

Soar through the stars as a starship commander in this exciting new space ship simulation. This new, advanced version of Startrek uses the full colour graphics and sound facilities of modern micros. Full 3D — Klingon attacks, graphic hyper-warp, plus all the normal 'Startrek' features and a whole lot more, add up to one of the best games in the galaxy!!

48K Spectrum £5.95.

KILLER SATELLITE

A mysterious Black Box has appeared in earths' orbit. You have to send your killer satellite to Probe it with high energy lasers. Amazing 3D colour graphics and sound for the Model B only £5.95.

3D CONNECT 4

An advanced, challenging four in a row game for the BBC Micro. Displayed in full 3D-perspective and using the extensive colour and sound facilities of the BBC Micro. Model B only £5.95.

DEALERS

For more information on our Generous Dealer Discounts and our special promotional packs write to Silversoft Ltd (Dealer Discounts) 20 Orange St London WC2H 7ED.

MACHINE CODE DISASSEMBLER

Simply the best Machine code disassembler available. Written entirely in machine code it has a host of features not available on inferior programs including automatic offset calculation, m/code jump following and printer output option. Only £6.95.

PROGRAMMERS

Tired, fed-up, ever wished that you could get some reward for your efforts. Well now YOU can make money from your micro. We're looking for high quality software for the ZX-Spectrum, BBC Micro, Dragon, VIC 64 Oric and Lynx micro computers so send off your programs today for a speedy reply.

Please send me _____

I enclose a cheque/PO for £ _____

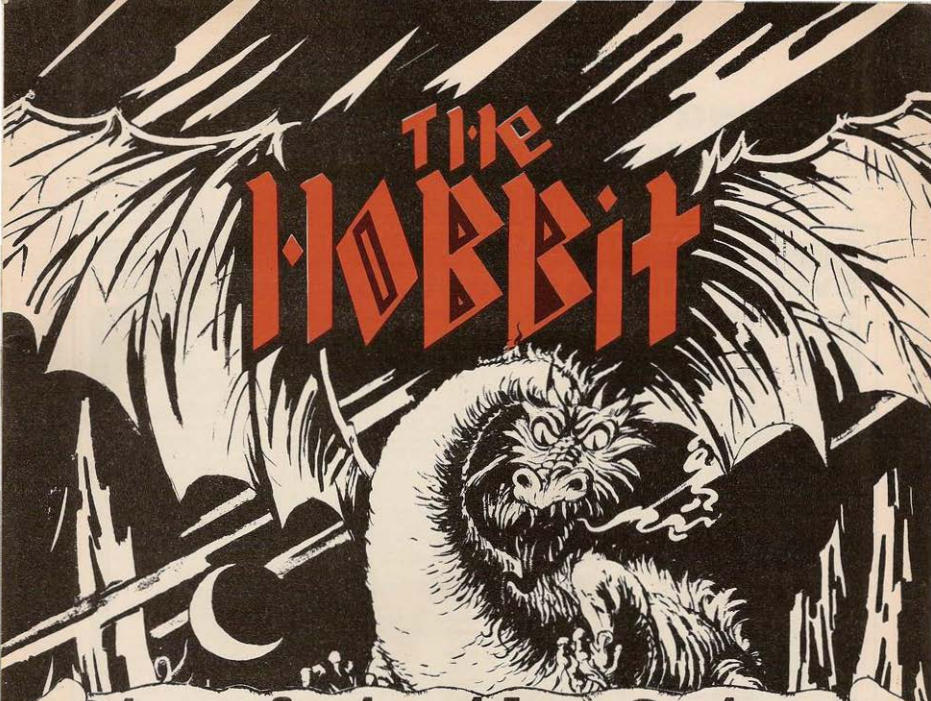
Name _____

Address _____

_____

_____

Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.



Step into the future:

VISIT MIDDLE EARTH WITH YOUR SPECTRUM.

Melbourne House Publishers, in association with the Tolkien Estate, are very proud to announce the release of THE HOBBIT, a super-program like no other before, for the 48K Spectrum.

THE HOBBIT is totally unique, with features never before seen on any computer, let alone on the Spectrum.

Based on the fantasy land described in J. R. R. Tolkien's brilliant novel, in this program you take on the role of Bilbo, the hobbit: danger, adventure, and excitement are all part of it, presented to you in words and graphics, but it is you who must confront and solve the problems this time.

You instruct the computer in completely ordinary English sentences!

THE HOBBIT program is capable of very sophisticated communications, including features not previously thought possible on a microcomputer: adjectives, adverbs, multiple sentences, are just a part of the power of this program.

You will meet all your favourite characters from J. R. R. Tolkien's book, and amazing as it sounds, they will all have an independent life of their own. They can make decisions and act on them! They react not only to what you do, but also to every other character in THE HOBBIT!

Because of this unique feature, you will find that each time you play THE HOBBIT, events will proceed in a slightly different way, and the further you get into Tolkien's world, the more different each visit may be.

THE HOBBIT also allows you to talk to the other characters! At last you can answer the questions they may put to you, or more importantly, you can suggest to them what you would like them to do!

THE HOBBIT program follows closely the plot of the book, and so a copy of the book is included as part of THE HOBBIT package at no extra charge.

THE HOBBIT brings to you the future of microcomputers in an exciting and challenging fantasy. A super-program that is a milestone in computer software.

Other cassette software includes PENETRATOR, a 48K state-of-the-art arcade game–£6.95 including VAT.
Spectrum books include: Over The Spectrum–£6.95.
Spectrum Machine Language–£6.95.
Understanding Your Spectrum–£7.95.

Melbourne House Publishers YC1
Orders to: 131 Trafalgar Road, Greenwich, London SE10.
Correspondence to: Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA.

☐ Please send me your **free** Spectrum Catalogue.

Please send me:
☐ The Hobbit package–48K Spectrum cassette, full colour instruction manual and Hobbit book–£14.95
☐ Other .....
(Please add 80p for post & pack.) I enclose cheque/money order £..... for my Access card No..... Expiry date.....
Signature.....
Name .....
Address .....
.....
..... Postcode.....

MELBOURNE HOUSE PUBLISHERS

PERSONAL SOFTWARE SERVICES

Everything you want for your ZX81

MAZE DRAG RACE: £3.95

Drive through a giant maze 9 times the size of the screen picking up points as you go — but watch out for the other cars, rocks, oil and ice. A really superb M/C game.

MCODER: £7.95

The most flexible compiler available for the ZX81. Extremely simple to use — simply load the MCODER (which is just 2K long and entirely in machine code) and then write your Basic program as you normally would. Run and Debug your Basic program until it is fault free. Then enter the MCODER (using a print USR command) — the Basic will then be compiled into machine code as you watch.

DCODER: £5.95

Essentially a dissassembler for your machine code but with one important difference — it will relocate the code in whole or part to any other part of memory.

ACCOUNTS: £4.95

A superb program for your ZX81. Accounts is a complete home accountant — does everything but pay your bills! Ideal for use with QSAVE.

QSAVE: £15.95

Now a well established best seller. Many testimonials its use and effectiveness. This hardware/software combination increases the locading and saving speed of your ZX81 16 Times (to 4000 BAUD). This allows a 16K program to load in only 29 seconds!! Also included is a verify feature which means no more lost programs. *No* modifications to your ZX81 are needed to use Q SAVE. Operates with either machine code or Basic. Any programs you already have on tape can easily and quickly be translated into Q Save code ready for fast loading. The program can be used with any memory — 16, 32 or 64 and will operate on programs of any length (even 48K which loads in 116 secs).

KRAZY KONG: £3.95

All machine code version of the popular arcade game. This program has all the features of the original and is very bist as fast.

GHOST HUNT: £3.95

Gobble your way through a maze — Ghosts, Power pills etc etc. Very fast.

ZONIX: £12.95

Sound effects for your ZX81.
ZONIX is a hardware/software combination that allows you to write programs with real impact.
The software includes two programs.
1 A program set to produce Bombs, Missiles, Fire Engines, Tunes, Telephones and Sirens and the facility to make your own.
2 A program that turns you ZX81 into an Electronic Organ.
The hardware is an amplifier with volume control and loud speaker which plugs into the mic socket of your ZX81.
The sounds can be actuated from within your programs with a simple command. They can also be of various lengths so the limit is only your imagination.

and now for your DRAGON 32

TEXT STAR: £12.95

Another highly professional program TP enhance your Dragon. Textstar gives you many more single key commands to make the writing & editing of your programs & text quicker and easier — eg. Line Swap, Get Lines, Sort Lines, Join Texts plus many others. This remarkable program also gives you full word processing power — letters can be properly formatted, paragraphed, edited and printed all by using single key commands.

DRAGBUG: £9.95

A monitor/disassembler for your Dragon. This is a useful software tool for writing, debugging and running machine code programs or subroutines. Features include display memory contents, alter memory contents, offset calculation, register display, disassemble memory, shift blocks of memory.
An essential addition to your software library.

STAR TREK: £7.95

An advanced version of the popular game. Includes all the usual features and more — Photon Torpedoes, Phasers Battle Computer, Damage Reports etc.... etc....

DATAPLAN: £12.95

This extremely powerful data filing system has been written as a true professional program. The program can handle over 100 records each of which can contain up to 10 lines of information. These can be automatically sorted, viewed, deleted or searched. The information can then be printed out in complete or part format as required. A compact and versatile program which has been proved by months of use in our offices.

CHEQUE OR PO TO: PSS, 452 STONEY STANTON RD, COVENTRY

How Epson beats the competition.

What competition?

The amazing HX-20.
The most complete portable computer available today.

The HX-20 is a portable computer with a full size typewriter keyboard, LCD Virtual Screen, printer and microcassette facility actually built in. A computer with a rechargeable power source that's large enough for writing programs and manipulating data virtually anywhere, yet small enough to carry in a briefcase.

But don't let the size fool you. The HX-20 is not a gimmicky toy or an excuse for a calculator. It's a precision machine using a full extended version of Microsoft BASIC with 16k RAM, optionally expandable to 32k and 32k ROM expandable to 64k, RS-232C and Serial interfaces. The ASCII typewriter keyboard and live programmable keys brings ten separate program functions to your fingertips.

Power to your elbow.

The HX-20 runs on its own power supply for over 50 hours and can be easily recharged overnight, or whilst in use, with the ability to retain its memory in RAM even when switched off.

Keeping you in the picture.

The LCD screen is unique – showing any 20 characters by 4 lines at a time – enabling you to carry out word processing or data entry as if you are using a large screen.

Print Out. Built In.

The 24 column dot matrix impact microprinter offers 42 LPM in a crisp, precise 5 x 7 matrix for perfect hard copies. Every time. And you can choose from a wide range of peripherals from bar code readers to acoustic couplers for total capability.

Epson. Reliability through Research.

You'll find our name on a highly successful range of computer printers. So you can be assured of the same quality and reliability through an extensive research programme prior to the launch of any Epson product.

Write or call us for further details and the name of your local stockist (because seeing really is believing).

Just take a glance at the competition and you'll soon realise that the HX-20 is the most portable computer available today.

Epson (UK) Limited
Freepost, Wembley, Middlesex HA9 6BR
Freefone: 2730. Telex: 8814169

HX-20
PORTABLE COMPUTER

EPSON

Extraordinary product.
Exceptional quality.

GREAT GIFTS COME I

for the
VIC 20

Bug-Byte programs make ideal Christmas stocking fillers! If you have a friend, or member of the family, who already owns a ZX81, Spectrum, VIC, Atom or BBC Micro they will be thrilled by the gift of one of our beautifully packaged, exciting cassettes.

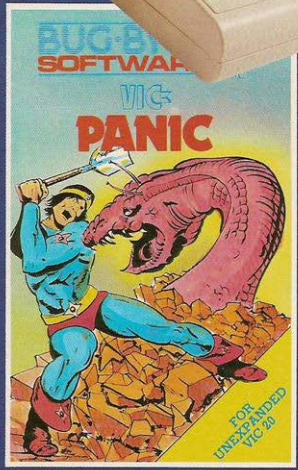
Whats more, Bug-Byte games are the best! Tens of thousands of contented customers testify to that, so do consistently hot reviews in the popular micro-press.

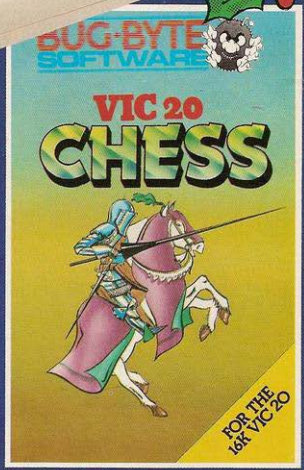
If your game isn't shown, don't worry, we probably have more quality programs for more machines than any other software house, and new ideas are constantly being generated by our young, enthusiastic team of skilled programmers.

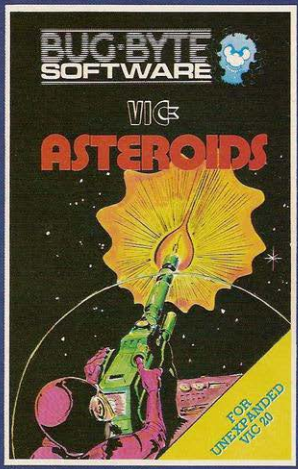
BUG·BYTE SOFTWARE
AUTHORISED DEALER

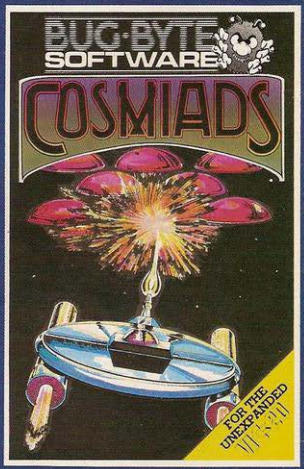
WHERE TO BUY?—
Look for the sign!
Bug-Byte programs are AVAILABLE NOW from:
All Laskys Stores Nationwide. Large branches of Boots and Curry's Micro-C, plus over 100 independent computer dealers.
If you can't find a Bug-Byte dealer near you – then fill in the coupon opposite and order direct by post – and receive your free copy of our 1983, 16 page, full colour brochure, it's packed with lots of enthralling games for the whole family.

BUG·BYTE SOFTWARE







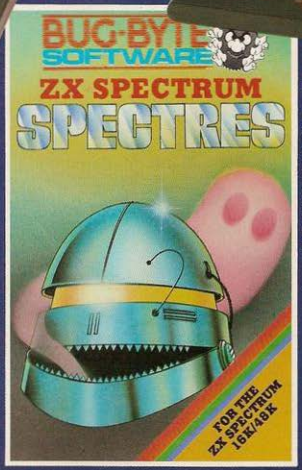


Also for your VIC:
Backgammon
Another VIC in the Wall

All VIC Programs – £7.00 each including post and packing

N SMALL PACKAGES!

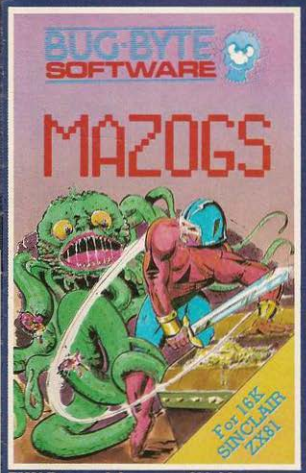
for the
SINCLAIR ZX 81
or
ZX SPECTRUM

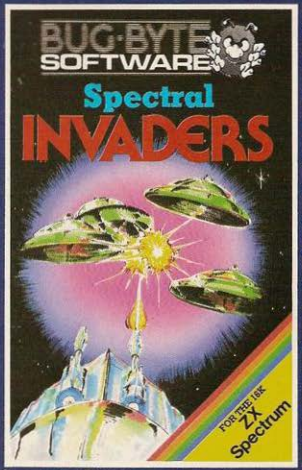


BBC Micro

We have a large selection of programs for the BBC Micro (A and B models). Our new brochure gives a complete listing, so send for your free copy today! Also see our huge range of software for the ever-popular Acorn Atom!

50p VOUCHER
with all orders of 2 tapes or more





ZX81 Prices: Mazogs – £10.00
ZXAS Assembler – £5.00
ZXDB Debugger – £6.50
ZXTK Tool Kit – £6.00
ZX Invaders – £4.00

Spectrum Prices:
Spectral Invaders – £5.00
Spectres – £8.00
'Aspect' Assembler – £9.00
All prices include post and packing

Please send me:

VIC Panic	☐	Spectral Invaders	☐
VIC Asteroids	☐	Spectres	☐
VIC Chess	☐	Mazogs	☐
VIC Cosmiads	☐	ZX AS	☐

OR the following: _____

I enclose S.A.E. for Catalogue ☐

I enclose cheque/P.O. for _____

OR Please debit my Access 5224 _____

Barclaycard 4929 _____ Expiry Date _____

Name _____

Address _____

_____ Code _____

Dealers Discount Available

ACCESS, BARCLAYCARD ORDERS WELCOME ON 24hr. ANSWERPHONE 051-227 2642,

or mail to:
BUG-BYTE SOFTWARE, FREEPOST (No stamp req.) LIVERPOOL L3 3AB.

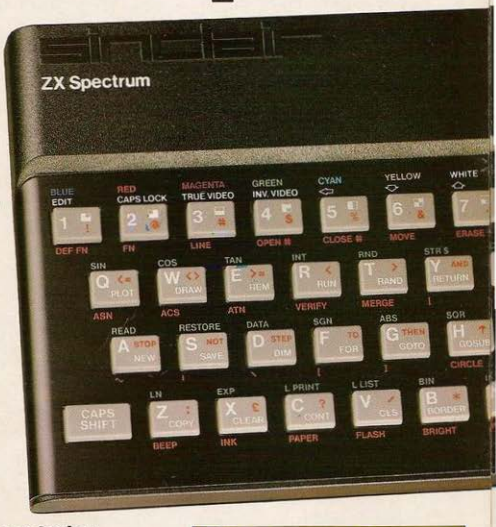
BUG-BYTE SOFTWARE

YC 1/83

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power–personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

ZX Spectrum software on cassettes – available now

The first 21 software cassettes are now available directly from Sinclair. Produced by ICL and Psion, subjects include games, education, and business/household management. Galactic Invasion...Flight Simulation...Chess...History...Inventions...VU-CALC...VU-3D...47 programs in all. There's something for everyone, and they all make full use of the Spectrum's colour, sound and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

sinclair

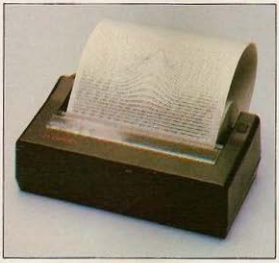
Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS. Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

YOC901

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

ORIC-1
ESC
CTRL
SHIFT
RETURN
ORIC-1™
TIMELESS TECHNOLOGY FROM ORIC PRODUCTS INTERNATIONAL

The Computer Challenge

16 colours
professional keyboard
full graphics
real sound

FREE FORTH with every 48K model.

- Superb styling
- Choice of 16K, [redacted] or massive 48K RAM
- Ergonomic keyboard with 57 moving keys
- 28 rows x 40 characters high resolution
- Teletext/viewdata compatable graphics
- 6 octaves of real sound plus Hi-Fi output
- Centronics printer interface and cassette port
- Comprehensive user manual

THE REAL COMPUTER SYSTEM FROM

£99.95

incl VAT

OPTIONAL MODEM OFFERS COMPUTER PHONE LINK FOR:
● ELECTRONIC MAIL ● TELESOFTWARE ● PRESTEL

COMING SOON, TO COMPLETE YOUR SYSTEM: ORIC MICRO-DRIVE DISCS & SPEED PRINTER

FOR HOME: The ORIC-1 is the professional alternative for home computing. Superbly styled, the 57 key layout is based upon computers costing many times more than the ORIC, and will help the whole family to learn and understand computing, right from day one. The ORIC incorporates an improved version of Basic for ease of programming and use. For the enthusiasts the computer has laser zaps, explosions, etc. pre-programmed for games use, with Hi-Fi output for incredible effect. The communications Modem will allow 'Telesoftware', message sending, and Prestel use.

FOR BUSINESS: The ORIC-1 is the answer to many day to day problems. Software is becoming available for payroll, accounts, stock-control, and many more systems to help your day to day business organising and control. In addition, the ORIC COMMUNICATIONS MODEM will allow you to access up to 200,000 pages of Prestel information, to send and receive 'electronic mail', to book hotels, and flights (and pay for them) and to look at the latest stock-market and share indexes.

In short the ORIC-1 is a must for all businesses large or small.

HOW TO ORDER YOUR ORIC-1: By phone: Just ring our telesales number Ascot (0990) 27641.

By post: You can pay by cheque, postal order ACCESS – BARCLAYCARD – AMEX – DINERS.

ORIC-1

The Real Computer System

ORIC PRODUCTS INTERNATIONAL LTD Cowarth Park Mansion, Cowarth Park, London Road, Sunninghill, Ascot, Berks SL5 7SE.

Prices include VAT

ORIC-1 16K RAM	£ 99.95
ORIC-1 48K RAM	£169.95
ORIC Communications Modem	£ 79.95
Postage and Packing	£ 5.95
TOTAL	£

(Money back if not satisfied)

Please charge my Access, Barclaycard Amex, Diners Club account no.

*Please delete/complete as applicable.
*I enclose a cheque/p.o. payable to: ORIC PRODUCTS INTERNATIONAL LIMITED for £

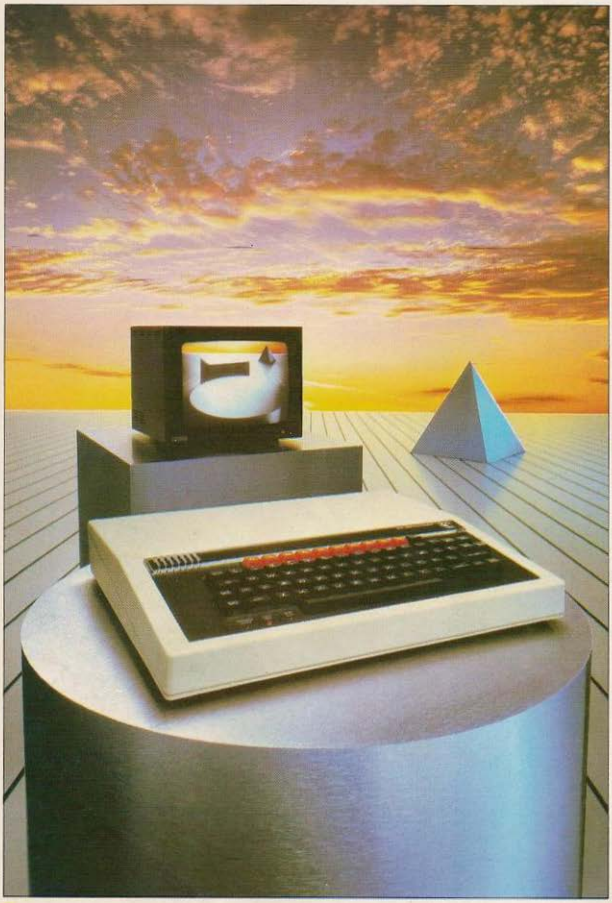
Name

Address

If you require a brochure please tick ☐

YC

© Copyright ORIC PRODUCTS INTERNATIONAL 1982



'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel.'

You can connect directly* to cassette recorder, domestic television, video monitor, disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form, send stamped addressed envelope to P.O. Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

Broader horizons

BBC Model B Microcomputers are available for immediate despatch by courier to your door.

If you would like to take advantage of our special delivery offer just fill in this coupon, but remember this only applies to the Model B, and only in the UK. Any other items have to be ordered on the standard order form or from a BBC Computer Stockist.

BBC Microcomputer System Offer
c/o Vector Marketing
Dennington Estate
Wellingborough
Northamptonshire NN8 2RL

Please send me by courier_____BBC Model B Microcomputer(s) at £399 including VAT and delivery.

Cheque enclosed for £_____
payable to BBC Microcomputer System
readers a/c or charge
ACCESS BARCLAYCARD

Signed_____
Name_____
Address_____

Postal Code_____

Co Reg No 1403880 VAT No. 215400220

The BBC Microcomputer System

BBC Microcomputer System Offer, c/o Vector Marketing, Dennington Estate, Wellingborough, Northamptonshire NN8 2RL.

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research.

The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

YOUR LETTERS

ZX GAMES

Several errors crept into my article ZX-81 Games Writing in the November issue of *Your Computer*. These are as follows:

1. Program 2 — an open brackets symbol is missing in the Line 1 Listing. This should be placed between Not and Clear.

2. Program 5 — the graphics character before the second RND should be CHR$63h not a space.

3. Hexloader — line 60 should read:

```
60 PRINT AT 11,7;X;"spc.";A$(1 TO 2)
```

Text should read: "To save typing both Rem statements type in line 1 Rem 255 0s".

4. Frogger program — to Run the display Line 10 should be changed to:

```
10 RAND USR 16701
```

not USR 16702, as stated.

Stuart Nicholls,
Keynsham,
Bristol.

GREMLINS

Here are some amendments to Rod Hopkin's Spectrum Flight Simulator — December issue — which other readers may find helpful. Most of them arise because the screen construction plotting commands do not correspond entirely with those of the main program.

Line 103: change address 23054 to 23086 and similarly change lines 8745 and 9521.

```
8710 DRAW 84,0 instead of 86,0
9657 DRAW 84,0 instead of 86,0
```

In line 9651 A$="\" should read

```
A$="(12 graphic 5s)"
```

Add the following lines:

```
9658 PLOT 30,7: DRAW 28,0
9501 POKE 23200,0
```

There are also some errors in figure 3:

```
Line 24 FOR N=1 to 14
```

should be:

```
FOR N=1 to 16.
```

To tidy up the screen display, the following line may be added to figure 3:

```
1010 OVER 1
1020 PLOT 31, 17
1030 FOR Q=143 to 153: PLOT Q,
     23:NEXT Q
1040 PLOT 143, 25: PLOT 152, 25:
     PLOT 153,25
1050 PLOT 152,33: PLOT 153,33
1060 OVER O
1070 PRINT PAPER 4; AT 18, 18; "O".
1080 PRINT PAPER 4; INK 7;
     AT 19, 18;"O"
1090 FOR Q=143 to 152: PRINT INK 7;
     Q, 31: NEXT Q
2000 OVER O
```

S Rendall,
Abergavenny,
Gwent.

MACHINE CODE

I would like to make an amendment to figure 7, page 68 of the October issue. Lines 16540 to 16547 are missing — these can be seen in program 5c immediately above the erroneous program 7.

The code from address 16540 to 16546 has been omitted. It should have been the same as in program 5 above it, that is:

```
16540  LD HL (NN) 42 12 64
       LD DE NN 17 3 0
       ADD HL DE 25
```

Perhaps I can add two further points to the series which may help readers list and edit the program.

We use 118 for the end-of-line marker and this, of course, will stop the printer and Rem from going beyond the point at which the number first occurs. You can get round this problem by using the following technique:

Required	Solution
LD A N 62 118	LD A N 62 117
or	INC A 60
LD C N 14 118	LD C N 14 117
	INC C 12

Only one point to watch. INC affects the flag variable. Also if you use the number 126 in your machine-code program, the five digits which follow it will not be shown on the screen.

Sinclair uses this code to indicate that a number follows, the number being stored in the next five addresses. If you now enter the code into the editor, parts will disappear. Solution — if you use the code 126 in your program, you must not edit the line. Try it, and see what happens.

Kathleen Peel,
Crowborough,
East Sussex.

HAUSER VIEW

I would like to point out a few factual errors in your interview with Clive Sinclair since it refers to an earlier interview with me. Sinclair's claim in paragraph 2, page 39 of your November issue that his display takes 8K to do exactly the same as Acorn's display does in 20K is incorrect. As some people know, our display has the following eight graphic modes:

	Model B only	
0	640 × 256 2-colour graphics and 80 × 32 text	(20K)
1	320 × 256 4-colour graphics and 40 × 32 text	(20K)
2	160 × 256 16-colour graphics and 20 × 32 text	(20K)
3	80 × 25 2-colour text	(16K)
	Models A and B	
4	320 × 256 2-colour graphics and 40 × 32 text	(10K)
5	160 × 256 4-colour graphics and 20 × 32 text	(10K)
6	40 × 25 2-colour text	(8K)
7	40 × 25 Teletext display	(1K)

The Sinclair display has only one mode, and it can only display 40 characters on the screen, giving neither the 80-character option necessary for word processing, nor the 20-character option needed for demonstration to a number of people gathered around the display.

The main shortcoming of the Spectrum display, however, is its lack of high-resolution colour graphics: since colour can only be assigned to character fields, as opposed to individual pixels as in the Acorn computer range, the colour resolution is only 32 × 44 = 1,408 colour fields, as opposed to 160 × 256 = 40,960 in the Acorn case.

The lack of a palette, which allows instant colour changes on the screen, is another difference between Sinclair and Acorn. A palette is vital for animated graphics.

I also found Sinclair's old advertisement in your November issue, which still compares the Spectrum board with the BBC board, claiming that the Spectrum "provides more power". In a recent test the BBC Computer was shown to be almost four times faster than the Spectrum.

Although I think the Spectrum is a reasonable computer, Sinclair's claims that it is "more powerful" than the BBC Computer and that it can do with 8K of memory what we need 20K for, cannot be substantiated and are simply false.

Hermann Hauser,
Managing Director,
Acorn Computers.

PROGRAM NAME

I have been very pleased with Mr Alan Went's Program Name for the ZX-81, November, page 110. However, some of your readers may have been having problems with it. It will work perfectly with the improved ROM, but with the original ROM — the one with the arithmetic bug — it will only work in Fast mode. In Slow mode it will print rubbish and sometimes crash. This is because it incorporates a call to the Fast routine and this was moved when the ROM was improved.

If you have the original ROM alter the beginning of line 10 to

```
LET A$ = "CD200F
```

or use the program as it is, but then execute the instruction Poke 16515,32. In both cases the beginning of line 1 will then appear as

```
REM LN 4?
```

It is also worth mentioning that the routine does not alter the print position and so can be embedded easily in a fancy presentation. For example:

```
10 PRINT "PROGRAM TITLE: """";
20 RAND USR 16514
30 PRINT """"""
```

will produce:

```
PROGRAM TITLE: "NAME"
```

Finally, the program is not relocatable, as it incorporates calls to itself, but I will leave that up to the readers' intelligence.

G J W Cunliffe,
Horsham,
West Sussex.

BBC FACTS

In reply to G A Bobker's letter, November, there are some facts that I feel should be corrected. I own a BBC Micro and, although I do agree that it is expensive, I do not agree with his comments on BBC Basic.

Overall, the BBC Micro mixes the best of both worlds. G A Bobker also said it was preferable to buy cheaper computers, hence more. He suggested a ZX-81 as an example of this idea, but I can tell you from personal experience that Sinclair Basic is even more non-standard than BBC Basic is supposed to be. An example of this is using X$(...) instead of the standard Mid$, Left$ and Right$, which the BBC uses, for string slicing.

P M Exell,
Great Missenden,
Buckinghamshire.

ZX LOAD

Many thousands of ZX-81 users are still plagued by the machine's inability to Load and Save regularly. The problem seems to be that the TV is emitting a very powerful mains hum, which interferes with both tape recorder and computer. Try this: first of all, type Save "Filename", then insert the Mic lead from the ZX-81 into the appropriate socket in the recorder. Next, insert a small earphone into the earphone socket on the recorder. Now, turn off the TV and allow it to cool down. Press Play/Record and Newline. You will know then the Saving is complete, from the sounds coming from the earphone.

This done, the program should Load back with little difficulty.

Robert Lazarus,
Harrow,
Middlesex.

ONE-LINER

Andrew Glaister's strange Spectrum One-Liner, page 25 November issue, creates its spectacular graphics by a software bug which can, however, produce several useful results. The fault stems from the angle portion of:

```
PLOT x,y:DRAW a,b,n*PI
```

if large odd values of n are used. But when n=63 an octagon is drawn, inscribed on an imaginary circle whose diameter is defined by the line joining (x,y) and (x+a, y+b).

If the value of n is altered to 189 an eight-pointed star is drawn. 24, 56 and 72-pointed stars can be drawn, using appropriate values of n. The following program shows the effect clearly by drawing a 3D view of an octagonal conic:

```
10 LET n=63
20 FOR a=120 TO 30 STEP -10
30 PLOT 55,27 : DRAW a,a,n*PI
40 NEXT a
```

The list below shows the values of n that produce well-defined shapes. I have not yet been able to produce any sharp images of odd-sided polygons or stars.

	n				
Octagon	63	441	567	.	. .
8 side star	189	315	693	819	. .
24 side star	105	147	273	357	. .
56 side star	225	279	297	.	. .
72 side star	301	343	.	.	. .

Alan Marley,
Ruislip,
Middlesex.

Blank Hitachis greet Spectrum

SOME SPECTRUM OWNERS have found that they are unable to get a colour display on their colour televisions. The Spectrum's colour signal appears to be incompatible with certain makes of colour television built overseas. The problem has been reported with TVs from Hitachi, National Panasonic, Toshiba, Grundig and Telefunken, although it does not occur on every model in these manufacturers' ranges.

Sinclair says that although the Spectrum was tested on a variety of different makes, it could not have been expected to have covered all television manufacturers. However Sinclair is now considering publishing a list of recommended makes.

Sinclair gives fiction prize

WHEN THE SINCLAIR fiction prize was first announced many people wanted to nominate Clive Sinclair himself for promising 28 days delivery on the Spectrum.

Now, with machines available over the counter at large branches of W H Smith the real winner can be revealed. *Death is part of the Process* won Hilda Bernstein £5,000 for a piece of fiction based on the grim reality of her battle to win human rights for women and blacks in South Africa — the country she and her husband fled in 1964 after he was arrested with Nelson Mandela.

Mandela is still in the prisons of South Africa's apartheid regime.

Customised to public speaking

CHATTERBOX IS THE NAME of a new phoneme speech synthesiser for the ZX-81 and Spectrum microcomputers. Unlike speech packs which provide a number of already formed words, phoneme speech synthesisers supply the component sounds of a word — vowels, diphthongs and consonants. You need to be a skilful programmer to take advantage of phonemes but they allow you an unlimited vocabulary.

William Stuart Systems, the manufacturer, says that an average of six bytes will store the phoneme codes for a spoken word, so 10K bytes would store over 1,600 words.

The system includes an amplifier and a loudspeaker and has sockets for a speech recognition unit and a music synthesiser, also supplied by the manufacturer. It costs £56.53 from William Stuart Systems Ltd, Dower House, Herongate, Brentwood, Essex CM13 3SD. Tel: 0277 810244.

Casio's £80 light-weight PB-100 joins personal-computer club

CASIO INSISTS that the PB-100 is a personal computer and not just a glorified calculator. A cheaper and slightly less powerful version of the FX-700P, the PB-100 runs Basic and can take up to 544 program steps. When a plug-in RAM pack is added it offers a maximum of 1,568 steps which works out to be around 2K.

Like programmable calculators it allows up to 10 programs to be stored at a time and retained in memory when the power is shut off. Programs can also be held on tape if a cassette interface is bought as an extra.

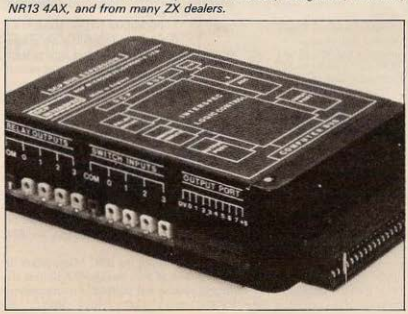
The PB-100 is remarkably light and compact, weighing just over 4 ounces measuring 9.8 by 16.5 by 0.7 cm. and costing less than £80. It has a 12 position LCD display and a 54 key alphanumeric keyboard, with single-key entries for Basic commands.

DCP Products who supply a range of accessories for the ZX-81 has developed this multiple interface pack for the Spectrum, the DCP Interspec. It includes an eight channel analogue to digital converter for joysticks or temperature sensors, eight-bit input and output ports, four relay outputs for high-current control and four buffered switch inputs.

There is also a 15-way connector at the rear of the pack which can control up to four more accessories as it stands or, with a few additional components, up to 255 other devices.

DCP's other new product is a Spectrum version of their speech pack for the ZX-81. This offers the letters of the alphabet, the numbers zero to a million, and a few other common words and sounds. By plugging in up to three Word Pack ROMs vocabulary can be extended to several hundred words.

The Interspec and Speech Pack, which cost £39.95 and £49.95 are available from DCP Products, 2 Station Close, Longwood, Norwich, NR13 4AX, and from many ZX dealers.



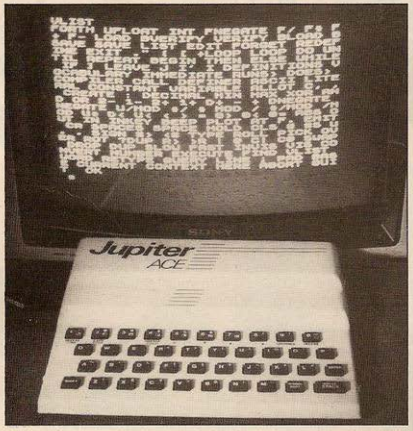
When in ROM, Oric EPROM

AT LAST ORICS are now streaming off the production line to start meeting the 250,000 orders already placed for the £99 colour micro.

The first few thousand do not have the final ROM chip but an EPROM instead. John Tullis, managing director of Oric Products International is confident that "users will not be able to tell the difference".

Oric decided to blow the EPROMs as soon as the design of the ROM had been finalised rather than have to wait another month for the production ROMs to be delivered.

At first Oric plans to concentrate production on the 16K and £175 48K models but a 32K machine at £140 is also planned.



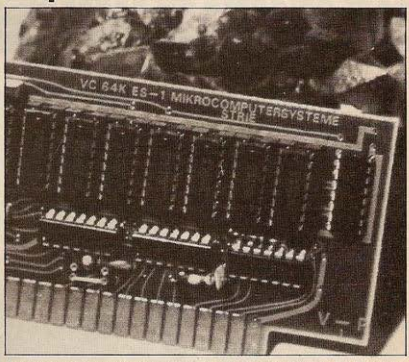
High Street dealers to hold all the Aces

The Jupiter Ace has overcome initial production problems and is now being delivered in numbers. Aces are now beginning to appear in high street stores. Jupiter Cantab is producing 3,000 units a month. The Cambridge based company hopes to phase out mail-order deliveries and handing over distribution to several large chains, including Lasky's and Greens.

Software for the Ace is also on the way. Steven Vickers, who designed the fast Forth micro with Richard Altwasser, and three other software writers are developing a range of games and educational programs to be released shortly.

Meanwhile Remsoft has already released three tapes for the Ace. Programs include a disassembler, games, and a simple database with tape storage. They are available direct from Remsoft, 18 George Street, Brighton BN2 1RH. Telephone 0273 602354.

Double-Dutch RAM expansion for Vic-20



NORMALLY THE VIC-20 has a maximum memory capacity of around 28K and this requires an expansion board to take an 8K and 16K RAM pack together. Now a Dutch firm has produced a RAM pack which gives the Vic 64K RAM.

It uses the technique of bank selection to switch in different banks of memory into one area of the memory map. When the cartridge is plugged in 24K is directly visible to Basic; a further 40K can then be accessed by switching in blocks of memory, 8K at a time.

The cartridge has been developed by Electronic Supplies, Utrechtseweg 129, 6812 AA Arnhem, Holland. In this country it will be sold through the Spectrum dealer chain for £100.

Accessing an 8K bank involves Poking the bank number into a single memory location. Should you feel cramped with 64K there is even a possibility of creating 152K RAM with two 64K cards, one motherboard and a few standard expansion cartridges.

Stack Commodore Supercharger Lines, Circles and Fills

STACK COMPUTER SERVICES has combined the facilities of the Vic-20 expansion units, Vickits 1 and 2, in one cartridge, the Supercharger Plus. Vickit 1 is Stack's version of Commodore's Programmer's Aid; Vickit 2, like Commodore's Super-Expander, supplies a high-resolution graphics mode with commands such as Line, Circle and Fill.

As well as incorporating all the commands from both kits, the Supercharger Plus includes an extra 3K RAM and allows 8K and 16K RAM packs to be connected. It costs £49, or £45 without the 3K RAM.

Also available from Stack is a 40/80 column board for the Vic-20. This gives a 40-column monochrome display on a TV or 80 columns on a monitor. It costs £115 from Stack Computer Services Ltd, 290-298 Derby Road, Bootle, Liverpool L20 8LN. Telephone 051-933 5511.

YOUR COMPUTER TOP 20

Game	Company	Machine
■ Flight Simulation	Psion	ZX-81
■ Games Pack	Sinclair	ZX-81
■ Frogger	D.J.L.	ZX-81
■ Mazogs	Bug-Byte	ZX-81
■ Chess	Artic	ZX-81
■ Time Gate	Quicksilva	Spectrum
■ Escape	New Generation	Spectrum
■ Mazeman	Abersoft	Spectrum
■ Ground Attack	Siversoft	Spectrum
■ Arcade Pack	Control Technology	Spectrum
■ Spectres	Bug-Byte	Spectrum
■ Hoppit	Commodore	Vic-20
■ Bonzo	Audiogenic	Vic-20
■ Defender	Rabbit	Vic-20
■ Jumbo Pilot	Thorn EMI	Atari
■ Pac-Man	Atari	Atari
■ Star Raiders	Atari	Atari
■ Meteors	Acornsoft	BBC
■ Space Warp	Bug-Byte	BBC
■ Ghost Attack	Dragon	Dragon

YOUR COMPUTER BACK ISSUES

Just getting started in computing? Or perhaps you're already pretty knowledgeable and would like to extend your programming skills. Either way Your Computer back issues can help to fill your need for reliable and, above all, relevant information about home computing.

Every issue contains reviews of new computers, software evaluations, and surveys of add-on equipment together with informative articles which tell you how to get to grips with graphics, sound and machine code programming.

To obtain any of these back issues please complete and return the coupon printed below. Prices per copy including post and packing are: United Kingdom: £1.50. Europe: £2.00. Rest of world: £2.50 (by Air Mail)

Facilities provided on the Sinclair ZX81 and Spectrum, Vic 20, Acorn Atom and BBC micro have been examined in article after article, providing a comprehensive introduction to all the most popular home computers. Just run your eye down the Contents of our back issues and you'll see what we mean.

To order back issues complete the coupon at the foot of this page and send it with your remittance to the address shown on the coupon.

January 1982
Reviews: BBC micro; Wordprocessing on Atom; Morphy v. Champion (chess computers). Game — Treasure House. Education — ZX81 programs for school use. Vic 20 Software. ZX81 Graphics. A-D conversion. Interview — Kenneth Baker.

February 1982
Survey: ZX Software. BBC Graphics. ZX81 Animated Graphics. Vic 20 Music. Game — Dominoes. How to write chess openings. Atom Programming. Rubik's Cube on ZX81. Interview — Kerr Borland.

April 1982
Survey: ZX Ports. Sorting on ZX-81. BBC Graphics. How to write an Adventure Game. Atom line labelling. Game — Nim for ZX81 and Apple II. Interview — John Baxter.

May 1982
Survey: ZX Software. How to write a chess program. Games — Vic 20 Tank Battle; Magic Squares. How to show off your ZX81. Joysticks for the ZX81. BBC Graphics. How to write a word processing package. Interview — Richard Turner.

June 1982
Reviews: Sinclair Spectrum; Vic 20 Software; ZX-81 Keyboards. Games Vic 20 Mars; Othello on Flexidisc. Atom Utilities. ZX81 machine code monitor. How to build a portable computer. Interview — Ron Bissell.

July 1982
Survey: Atom Software. Spectrum Graphics. ZX-81 Colour Board. Games — Dog Race; Genie Guessing Game; Simon Challenge. BBC Sound. ZX-81 Dis-assembler. Programs for ZX-80. Interview — Richard Altwasser.

August 1982
Review: Dragon 32. Survey: Vic memory expansion. Spectrum Sound Games — Demon's Domain; Vic Duck Shoot. ZX-81 machine code (Part 1). Atom file handling. Ecological modelling. BBC techniques. Interview — Tony Baden.

September 1982
Review: NewBrain. Spectrum Software. Sound on ZX-81. Games — Vic Dambuster; B-52 Bomb Run. Vic-20 Assembler. Spectrum Disassembler. ZX-81 Indexer. ZX-81 machine code (Part 2). Midwich MC control computer. Interview — Hermann Hauser.

October 1982
Reviews: Sanyo PHC range; MPF-II; Commodore 64; Colour Genie. Survey: BBC Software. Atom Forth. Pascal for Basic users. ZX word processing. Games — ZX-81 Pinball; Vic Catacombs. Atom text. BBC control Key. Spectrum Assembler. ZX-81 machine code (Part 3). Interview — Douglas Adams.

Issue (month)	Year	Quantity required

To: General Sales Dept., Room 108, IPC Business Press Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Please send me the back issues detailed left – for which I enclose cheque/PO for £..... payable to IPC Business Press.

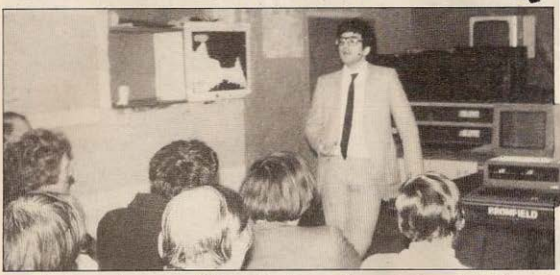
Name .....

Address .....

.....

Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.

Spying on the Cheltenham HQ



Just yards away Britain's top spies are hunting for moles but Simon Beesley finds Cheltenham's computerniks are still in league with the badgers.

CHELTENHAM AMATEUR COMPUTER Club meets at Prestbury Scout HQ along the road from GCHQ, the government's electronic eavesdropping centre and scene of the recent spy scandal. GCHQ is probably the largest employer of computer personnel in the district but hopes that some of them might make an appearance at the Scout HQ were frustrated — the centre has its own microcomputer club, a BBC users' group.

The Cheltenham club passed through a fallow period when they were uprooted from their normal premises in a local technical college. They tried to run weekly meetings from an annexe which closed at 8.30. Attendance flagged as a consequence.

Matters have improved now that they are securely lodged in the scout hall. A notice above the entrance to the hall bore the ominous legend: "Due to rain damage all members must keep off the roof". *Your Computer's* representative did not enquire whether this referred to the club's normal proceedings. Certainly at this month's meeting none of the 15 members attending showed any inclination to start climbing.

Peter Manolescue of The Business House, Gloucester demonstrated the Sirius, the 16-bit business micro. Computer clubs often invite dealers to demonstrate their machines. The drawback to this is that dealers are unlikely to take the most objective view of the machines they sell and usually cannot give as good a review of them as the experienced user.

Nonetheless Peter Manolescue gave a lively demo which developed into an informal discussion. Conversation ranged over the use of micros in schools, the merits of word processors and the future of keyboard input. Members showed particular interest in the high quality graphics which the 800 by 400 resolution of the Sirius permits.

Also on show was the HX-20, Epson's very impressive portable computer. It had been brought down from Compec that morning and at the Prestbury Scout Hall was making one of its first public appearances in the provinces.

The Club's members display a range of computing interests. Steve Smith has built a home micro around a Z-80 processor which runs Tiny Basic in 2K. Although his attempt to make a teletext adaptor for the micro failed, he has successfully built a thermal printer for it using wood for some of the parts.

Vera Naumann, deputy head of a local primary school, bemoaned the lack of adequate software for schools. She had just written her first educational program on the BBC Micro, a music multiple-choice test. Her next move is to include sound in the program when she has mastered the complexities of the BBC's Sound and Envelope statements.

Club meetings are usually based around a talk or demo. They also hold meetings devoted to members' micros and programs. A BBC night is planned following the success of their Sinclair night held earlier this year. Further information from Mike Hughes (Cheltenham 75213).

Local society news

Harrogate ZX users

THE HARROGATE ZX Users' Club meets fortnightly at the PHAB Club in Mornington Terrace, Harrogate. Although they are primarily interested in Sinclair micros they welcome other users. Contact Peter Richmond, 7 Dragon Parade, Harrogate HG1 5BZ.

Bolton computer club

THE RECENTLY-formed Bolton Computer Club holds weekly meetings in Room E4/24 at the Bolton Institute of Technology. Membership is £1 per annum and there is a 20p admission charge at some meetings. The majority of members are home micro hobbyists, but anyone who has any computing interests can attend. Contact Roy Mumford on Bolton 493682 or Dave Atherton on 0942 876210.

Ribble Valley

THE RIBBLE Valley Computer Club is a new club in North Lancashire. They meet on the second and fourth Mondays of the month at Pemble Carpets, West Bradford. Further information from Ian on Clitheroe 25933.

North London

THE NORTH London Hobby Computer Club co-ordinates a number of different user groups and computing courses. These include Basic and machine-code programming courses, a Women's Computer Group, and meetings for novices, Vic and Sinclair users. Send for a prospectus to The Secretary, Department of Electronics and Communications Engineering, The Polytechnic of North London, Holloway Road, London N7 8DB.

CHROMASONIC
PERSONAL COMPUTERS

01-263 9493/5

48 JUNCTION RD, ARCHWAY, LONDON N19 5RD Telex 22568

The Home Computer Specialists

Buy it with Access VISA

INTRO OFFER! VIC 20+
* Cassette deck * "Intro to Basic" part 1
* Joystick
* 5 Blank cassettes

£199

VIC20 COMPUTER

NEW LOW PRICE £149.00

VIC PRINTER £212.00
80 Characters per line, 30 Characters per sec., Tractor Feed Dot matrix printer.

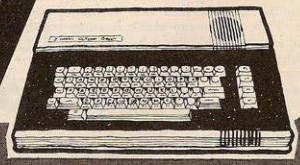
VIC SINGLE FLOPPY DISK
OUR PRICE **£286.00**
174K Byte Storage Direct Interface to VIC Direct Compatibility with printer.

VIC CASSETTE DECK £39.00
Free cassette with 6 programs supplied

COLOUR GENIE

EG 2000 PAL VERSION
* 8 colours
* 16K RAM standard, expandable to 32K
* Extended Microsoft colour basic standard
* Typewriter Keyboard
* CPU: Z80A/2.2 MHz
* 3 Sound Channels
* 40 Columns x 24 Lines
* Serial and Parallel I/O Ports

OUR PRICE **£199**



****** NEW **NEW** NEW ******

JUST RELEASED

The 64 from **commodore**

64K RAM
music synthesiser
3-D effect
16-colour display

OUR PRICE **£339**

ACCESSORIES FOR YOUR VIC20
Super Expander High Resolution Cartridge **£31.00**
Programmers Aid Cartridge **£28.00**
Machine code Monitor Cartridge **£28.00**
8K RAM Cartridge **£39.00** 16K RAM Cartridge **£67.00**

TONS OF SOFTWARE
For a copy of our VIC list containing everything you need for the VIC computer, send us your coupon NOW!

***** STOP PRESS *****
VIC 20 GAMES

CARTRIDGES	VIC1905	"JELLY MONSTERS"	£18
	VIC1914	"ADVENTURELAND"	£23
	VIC1917	"VOODOO CASTLE"	£23
CASSETTES	VIC3501	"QUIZMASTER"	£10
	VIC3502 a1	"KNOW YOUR OWN IQ"	£10
	VIC3511 BBC	"MASTERMIND"	£10

Post to CHROMASONIC Personal Computers, 48 Junction Road, Archway, LONDON N19 5RD

TERMS OF BUSINESS: All prices inc 15% VAT
Delivery charged at Cost. Prices valid for cover date of this mag.
Access and Barclaycard orders welcome.

I am interested in a home computer.
Please send me further details
☐ VIC 20 ☐ DRAGON 32 ☐ COLOUR GENIE
☐ ADD-ONS ☐ SOFTWARE

NAME: .....

ADDRESS .....

.....

.....

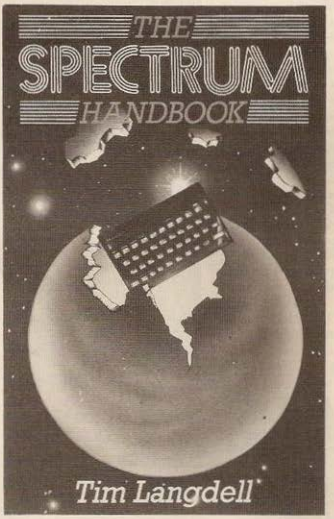
Please send me game No.....
I enclose cheque/postal order for £.....

Personal Computer World

CENTURY

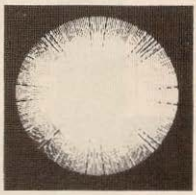
A must for anyone who wants to take their Spectrum to the limits – and beyond

The Spectrum Handbook



The Spectrum Handbook **offers its readers the opportunity of harnessing the power of the most exciting micro of the decade – The ZX Spectrum. Dr Tim Langdell believes that the machine's wide-ranging potential should be available to all Spectrum owners – not just those with previous computing experience. His step-by-step introduction opens the world of the Spectrum to beginners, whilst the wealth of hints and tips, exciting programs and comprehensive machine-code and applications chapters makes the book essential reading for even the experienced programmer.**

Contains more than 80 programs
224 pp £4.95 (paperback)



This picture has been produced from a single line of Tim Langdell's *Spectrum Handbook*

Available through bookshops everywhere. Should you experience any difficulty please fill in the order form below.

ORDER FORM
To: Department 01C
George Philip Services Ltd
Arndale Road
Wick, Littlehampton,
West Sussex BN17 7EN

Please send me _____ copy/copies of THE SPECTRUM HANDBOOK by TIM LANGDELL at £5.45 per copy (post paid)

I enclose my cheque/postal order for £
(Please make your cheque/postal order payable to George Philip)

Name _____

Address _____

_____

_____

Please allow 28 days for delivery

CENTURY

RESOURCE

WHAT'S ON THE FOR HOME COM

LOOK INTO the window. The year is 1993 and the only place you can find anything remotely like the micro you had in 1983 is an antique shop.

You pull out of your pocket a credit card-sized communications, information and resources centre and ask it why anybody bothered with home computers when the only way of communicating with the beast was to type in instructions by hand, or use a crude joystick.

After a discernible pause while the resource centre tries and fails to work out whether you were just being sarcastic, some archive film of the early days of home computing appears on the resource card's screen while a patronising commentary tells how the pioneers struggled against insufficient memory and bug-ridden programs back in the days when men were real men and RAM wobbles were real RAM wobbles.

1983 marks a turning point in the history of home computing. In February the number of micros in Britain will break the million barrier for the first time. Over the course of the year the introduction of cheap mass-storage systems and telecommunication links between micros and databases will make cheap home computers into useful working tools, while both the hardware and software to be introduced over the next 12 months will make today's computer games look positively stone age.

Now that home computers are here to stay, it is time to consider how they may develop over the next 10 years. Other than looking at tea-leaves there are three ways of assessing this. It is possible to extrapolate present design trends and combine them with what individual information companies are planning as their next products. Such is the speed of advance in microcomputing that this becomes impossible for time spans of more than a year ahead.

Secondly, if your examine the continuing improvements of silicon chips and the research into even faster and more compact computing units, organised in superior ways, you can make a reasonable estimate of the crude power of the home computers of the 1990s. Thirdly 10 years is roughly the timelag between the first laboratory experiments on a theme and its general introduction. Computer games were being played in laboratories in early 1960s but it was 1972 before the first one — Pong — appeared on general release.

Likewise the personal computer was developed in the mid-1960s but it was 1975 before Steve Wozniak founded Apple. On that basis the laboratory research work carried out between 1973 and 1983 should give a clue to what will be commercially available before 1993.

In general, computer hardware produces 10 times as much for any given price as it did three years ago. This trend has been consistent for the last 30 years so we can expect the 1993 model to be 1,000 times as powerful as today's machines. Although software develops much more slowly, for the first few years micro software can jump a stage. As they grow more like minis and mainframes in their power they can adapt off-the-peg suites of programs written for their larger relatives.

The first major step forward this year is as old as the disc, but the widespread intro-

TOMORROW'S TECHNOLOGY

RESOURCE

THE SKY'S THE LIMIT
Micro power jumps by a factor of 10 every three years. This exponential rate of growth makes 1993's home computer 1,000 times more powerful than 1983's.

CARDS
PUTING ?

RESOURCE

Hollywood took 30 years to turn black and white silent movies into colour talkies. The home micro industry has managed that in just three. Meirion Jones dons his gypsy scarf and gold ear-rings to look ahead at the next 10 years of home computing.

duction of 3in. and 3.5in. microfloppy drives for between £150 and £200 will make mass-storage systems accessible to home computer owners. By 1984 the price of a drive should be less than £100. At the lower end of the market Sinclair's Microdrive when it finally appears should be a great improvement on present cassette-based systems.

Video discs are also becoming a fashionable storage medium because of their ability to illustrate interactive games, promotions or education programs with real film. Philips Laservision can store the equivalent of 54,000 still TV pictures on one disc. Sony has already released its SMC-70 video disc-based computer system in America, where Ford and General Motors both use similar video-disc computer systems to sell cars. In Britain one firm is selling an interactive video disc-based system to teach medical staff how to diagnose illnesses.

At present the cost of such systems is prohibitive but there is hope.

In March Philips and Sony hope to wipe out the market for conventional LPs by launching a new 4.75in. laser disc and player. Already some record manufacturers plan to use the laser discs for a screen display to go with the record. It would be comparatively easy for software houses to put their programs on these new Compact Discs and incorporate real film sequences in interactive adventure games. Projected prices are in the region of £10 per disc, and although the players will originally cost £400 once they start selling in numbers prices will drop below £200.

1983's real innovation though will be communications between micros at a reasonable price. In February Oric will start delivering £60 Modems to fit on the Oric 1. This will make it possible to buy a colour computer and a Modem together for less than £160. Micronet 800 is another scheme to deluge computer owners with relatively cheap Modems, which starts this month. Before the summer Sinclair also hopes to join the Modem-makers' club.

In each case the motivation behind the scheme has been to sell software which can be downloaded from the phone much more cheaply and conveniently then by buying a cassette or cartridge and loading that in. If the technology is taken advantage of, it could be used to connect your home micro to vast databases containing most of the information you could ever need. You could send and recieve electronic mail to and from anyone else with a micro and a Modem. You could play interactive computer games against an opponent who might live in another city.

As 1983's home micros become more competent a new type of software will emerge to take advantage of the possibilities. Sinclair hopes to introduce a home doctor on the ZX-83 which will ask the patient what his or her symptoms might be before sorting through a base of information to eliminate most possibilities and following up likely leads with more questions.

At the end of the "surgery" the computer would produce a list of possible causes of the symptoms in declining order of probability. Such an expert system could be described as exhibiting artificial intelligence — a term which will be ruthlessly exploited and twisted out of all recognition by computer product sellers.

There is already an adventure game for the Spectrum called The Hobbit which the publishers describe as having AI. To be fair the adventure is apparently every bit as imaginative and entertaining as the publisher's claims for it.

Atari's Chief Scientist Alan Kay believes that however good the hardware is, home computers will never reach their potential unless Basic is discarded. Despite the evidence he thinks that for every child who takes to programming with enthusiasm there are a dozen who are put off by the time it takes to produce anything interesting in Basic.

"The last thing we want to do is bring up a generation of kids who hate computers because they had to learn Basic." Equally he has little faith in the "grown-up" languages which he thinks will become available on home computers over the next two years. Kay developed Smalltalk — a tool-building language which encouraged the young to make maximum use of the computer's capabilities, and which has recently become available on the larger micros. Soon it will migrate to the home computer.

Making the most of manipulative languages will mean that the home computer will start to acquire a whole new paraphernalia to make the user interface more friendly than a keyboard.

It is already quite simple to persuade a modern micro to respond to a few simple spoken commands. The computer does not

(continued on page 37)

ZX99

AUTOMATIC TAPE CONTROLLER FOR THE SINCLAIR ZX81

● DATA PROCESSING

The ZX99 gives you software control of up to four tape drives (two for reading, two for writing) allowing merging of data files. This is achieved by using the remote sockets of the tape drives, controlled by USR statements or commands.

● RS232C INTERFACE

The ZX99 has an RS232C output allowing connection with any such printer using the full ASCII character code (you can now print on plain paper in upper or lower case, and up to 132 characters per line) at a variable baud rate up to 9,600

● SPECIAL FEATURES

There are so many special features it is difficult to list them all, for example:

AUTOMATIC TAPE COPY: You can copy a data file regardless of your memory capacity as it is processed through the Sinclair block by block.
TAPE BLOCK SKIP: Without destroying the contents of RAM
DIAGNOSTIC INFORMATION: To assist in achieving the best recording settings.

The ZX99 contains a 2K ROM which acts as an extension to the firmware in the Sinclair ROM. The ZX99's ROM contains the tape drive operating system and the conversion to ASCII for the RS232C output.

There is an extension board on the rear to plug in your RAM pack (larger than 16K if required). The unit is supplied with one special tape drive lead, more are available at £1 each.

Now only £49.95
plus £2·95p+p

● ZX99 SOFTWARE

We now have available "Editor 99", a quality word processing program including mail-merge, supplied on cassette for £9.95. Also following soon:

* **Stock Control (October)**
* **Sales Ledger (November)**
* **Business Accounts**
* **Debtors Ledger**
* **Tax Accounting**

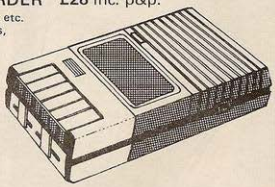
Dept. YC5 Data – Assette, 44 Shroton Street, London NW1 6UG. 01-258 0409

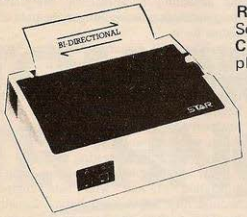
---

data-assette®
44, Shroton Street
London NW1
Tel 01-258 0409

● FERGUSON CASSETTE RECORDER £28 inc. p&p.

Tested with ZX81, Acorn, BBC, Dragon etc. etc.
Features: Din, Ear, Mic. and Remote sockets, Tape Counter, Tone Control, Built-in Mic., Autostop. Battery/mains. Recommended by Acorn for use with BBC computer.





● STAR DP8480
RS232C (SERIAL) £285 plus £6 Securicor delivery
CENTRONICS (PARALLEL) £265 plus £6 Securicor delivery

This professional printer works with almost any computer with very good upper and lower case typeface.

- Bi-directional
- 80 column width (10" paper)
- Switchable – Tractor or Friction Feed
- 80 chrs. per second

● 2,000 SHEETS OF PRINTER PAPER
£19.50 plus £3.50 p&p.

● E690 REVOLVING CASSETTE RACK

Single – **£2.99** (holds 32 tapes or 20 in cases)
Double – **£5.99** (holds 64 tapes or 40 in cases)
Treble – **£8.99** (holds 96 tapes or 60 in cases)
Quad – **£11.99** (holds 128 tapes or 80 in cases)
All plus £1 p&p.

● BBC CASSETTE LEAD

7 pin plug to two 3.5mm plugs and one 2.5mm plug. Only £2 inc. P & P.
Other leads available – please telephone.

COMPUTER CASSETTES

High quality, screw assembled cassettes supplied with library boxes. Any lengths available.

C5 – 35p	C10 – 37p	C12 – 38p
C15 – 39p	C20 – 41p	C25 – 43p
	C30 – 44p	

P&P 10% (min. charge £1.50)

ORDER FORM Dept YC1 Data – Assette, 44 Shroton Street, London NW1 6UG. 01-258 0409

Code	Item	No.	Price	P & P	Total

Cheques/PO made payable to Storkrose Ltd.
Charge my Access/Visa No. .....

Signed _____ Name _____
Address _____

(continued from page 35)
have to understand anything about meaning to respond to clearly-spoken, single-word commands — Speak to your Spectrum *Your Computer* November 1982. As home computing becomes more popular though, the temptation to do away with input through the keyboard will increase.

Even on mainframes the problems of recognising a word out of the stream of noises humans make when they are communicating with each other have not been totally solved. We distinguish similar-sounding words according to the context in which they are spoken. Until we start building computers which have somehow soaked up the same sort of picture of the world as the people talking to them, context will still prove a problem. Meanwhile much of the most successful work in speech recognition is classified because of its obvious defence and security applications.

Computer-generated speech is by contrast now a much easier problem. The Detroit dalek sound is aleady a thing of the past. Acorn's Kenneth Kendall speech chip is only the first of many voices that will humanise the sound of silicon.

Despite the low price and apparent appeal of the light-pen most computer-makers believe that a more modern approach is necessary. Sinclair for instance was considering making a light-pen available as an accessory but now research is concentrating on building complete systems of software and hardware designed to make the use of computers as easy as pen and paper.

One approach which the home computer-makers are thinking of borrowing from the minis is the mouse. The mouse itself is small and hand-held and can be moved around on the desk very much like a pen on paper. It produces a cursor on the screen which moves around as the mouse is moved across the desk. A few single controls on the mouse are enough to move sections of text or a design around on screen. In future the mouse could also be designed to read in text as required from a sheet of paper on the desk. At present even on minis the mice are connected by wire or fibre-optic link to the computer. The mouse will become far more effective once the physical connection can be discarded.

Since 1975 the home computer has changed out of all recognition but the television display which the user relies on has improved very little. Essentially the television or monitor is still the heavy box which it always was, displaying a small picture which you have to stare at. Now advances in flat-screen displays are changing all that and making light-weight, portable computers with built-in screens possible. Before the end of the decade it will be possible to produce a pocket-sized computer which could project a wall-sized display.

Sinclair's much delayed flat-screen project will be producing pocket televisions by next spring. We can expect flat screens to appear not only in Sinclair's computers over the next few years but in many others. The Japanese seem to favour large liquid-crystal displays for their flat screens but Sinclair relies on a flattened cathode ray tube with the electron gun displaced to one side. By 1984 he envisages making a 4ft. colour flat-screen television. You could then hang your game of space invaders, or a flight simulator, on the wall.

By the end of the decade computer enthusiasts will be expecting their machines to be throwing up realistic three-dimensional displays. It is unlikely that people will still be prepared to sit and wear red and blue glasses night after night — although one American company is producing arcade computer generation games which do require this — so, much research is proceeding into three-dimensional display.

Holographic techniques offer some promises in the long term but in the meantime the problem of three-dimensional display has produced some ingenious ideas. In America a laser has been used to illuminate rapidly rotating panels to give an illusion of depth. Rudiger Hartwig of Heidelberg University is using a variation of this to create a real three-dimensional display. A helix in a column spins at high speed while a laser illuminates it from above. By deflecting the beam across the helix at high speed an apparent line can be created inside the column. An electro-mechanical deflector is sufficient at present to generate lines, spirals and helixes in the column. Eventually Hartwig will use three lasers to produce colour with electronic deflection to speed up the process and hence produce higher definition.

In the late 1970s Massachusetts Institute of Technology used a mainframe to simulate the order of computing power which would be available in the home by 1990. A system called Dataland was developed which allowed the computer to go soft. You just had to sit in an armchair in front of a wall-sized TV display showing everything from a pocket calculator to a phone and a photograph album. Either using your voice or just pointing you could choose an item off the wall and then control it either on the wall display or on a small monitor by your chair.

To make a phone call for instance you would ask for the phone — which need never appear as a hard object — and when it appeared on your monitor you could have the choice of dialling the number yourself by pushing the buttons as they appeared on screen or by asking the computer to find and dial the number of a particular person for you.

If you chose to look at your photo album you could direct the computer with the minimum of fuss to blow up any picture you might want across the wall. Such a system with built-in word processors and expert diagnostic systems would hold a database of all the information in your house, making it easily accessible. It would also have links with large external databases in case you wanted information it did not have.

This computer would also be the entertainment centre for the home. Not only could you ask it to put on a particular television program but you could ask it to find and show an old film — downloaded from a rental agency.

All this depends on microtechnology continuing its exponential growth. All other things being equal there are two ways to make chips which will produce more computing power for less money. Either you must increase the speed at which the individual components, or logic gates, on the chip switch, or you must fit more of them on to a chip.

At the moment 250,000 gates can be fitted on to a single 10mm. square slice of silicon but new photographic techniques are increasing this density all the time. Hewlett-Packard now believes that such a slice could support the million gates needed for a 64-bit processor.

Meanwhile the military in particular are examining the possibility of using gallium arsenide instead of silicon to produce chips which will work five times as fast. In Britain the acronym-happy Ministry of Defence is funding the VHPIC programme to produce very high performance integrated circuits — while the American Defense Department is spending $200 million on VHSIC — developing circuits which will be 100 times as fast as present.

Although these developments take time to filter down from military to commerical use, — from the killing business to the business of making a killing — the time lag before new wonder chips appear in micros is decreasing all the time. As the U.S. Commissioner of Customs put it, with unnerving enthusiasm "The same technology which brings us the

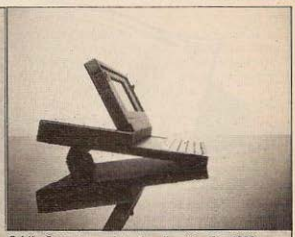
(continued on page 39)

The shape of 1983

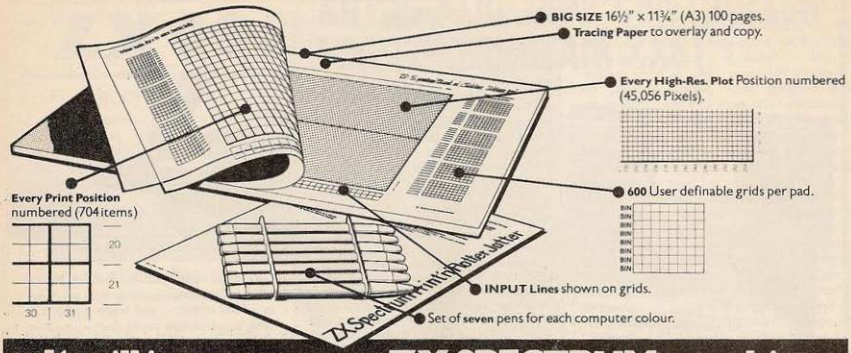
The machines released this year will offer more for less and are likely to come with useful applications already on board — there are hints that Sinclair's ZX-83 project may come with a built-in word processor. Price cutting will continue — the ZX-81 or its equivalent could cost £25 complete by the end of the year and Binatone insists that it is still going ahead with the £50 colour 16K micro despite delaying the launch from January to March.

Now Binatone plans to launch two other machines at the same time as the £50 Micro. Acorn hopes to finally launch the £150 Electron in February with a portable version to come in the summer. Portability will be an important theme this year. Sinclair is keeping his cards to his chest but the features he has previously mentioned — Sinclair Interview November *Your Computer* — still suggest that a small briefcase computer is a likely shape for the ZX-83. Nigel Searle, Sinclair's Research Director, will only say that while the Spectrum evolved from the ZX-81 the ZX-83 "will enter a new section of the market."

Apple is considering launching a new machine in the £200 price band, and Mattel makers of the Intellivision may hot up the competition with a £100 Spectrum contender. Commodore is again threatening to release the Max games machine at £100.



Grid's Compass points the direction for 1983.



It will improve your ZX SPECTRUM graphics in ways you wouldn't believe possible.

Your new ZX Spectrum is literally packed with sophisticated graphics. Colour. High resolution. Plot. Draw. Circle. Border. Ink. Paper Colours. User-defined characters to name just a few!

That's why we have packed the new Spectrum Print 'n' Plotter Jotter with every facility to exploit your graphics to the full.

After the first few weeks of "playing" with your computer you will want to get down to serious programming and planning in which professional-looking graphics should play a major part.

What better way to work it out than with a Print 'n' Plotter Jotter?

The professional pad

Print 'n' Plotter is not just another programming pad.

Just look at the specifications:

BIG SIZE 16½" x 11¾", 100 Pages — 50 Print Grids and 50 High Resolution Plot Grids.

Printed on high-quality tracing paper, enabling you to overlay the pages for direct co-ordination between PRINT and PLOT or to copy from illustrations, maps, charts, photos etc.

PRINT Grids show all numbered co-ordinates for the 704 screen positions, plus INPUT lines.

PLOT Grids show every numbered co-ordinate for the 45,056 Pixels!

Each pad contains 600 user-definable grids for use with the BIN n, POKE USR "a" function.

And the whole thing is fully bound with fly leaf cover and complete with a set of seven colour pens!

The simple way to get serious

Spectrum Graphics can become very complex, so before you start to program the best way is to work it out on a Print 'n' Plotter and save all those errors!

Take for instance the common CIRCLE. With a Jotter you can establish the exact screen location for the centre in seconds, and it will stop you running out of screen because of a too large radius. Working our DRAW is similar: pre-determine DRAW lines and PLOT positions before you start. With a Jotter you can build-up graphics using every facility with a direct co-ordination between each.

For instance, correct PLOT OVER or PRINT OVER positions will be easy with a Jotter.

See the show for just 60p!

To demonstrate the graphic possibilities with the SPECTRUM JOTTER we have produced a cassette-based Demonstration program for only 60p (inc VAT and P&P). Why not send for a copy, or order it together with your JOTTER?

Just part of a range of ZX products

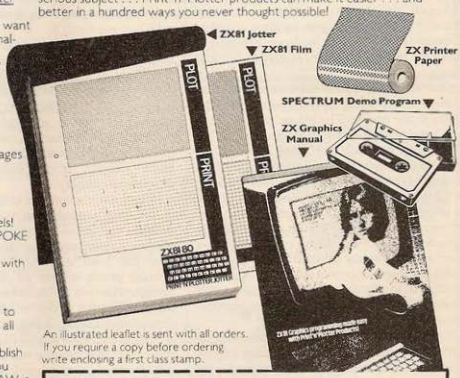
The Spectrum Jotter is, of course, an upgraded version of our popular *ZX81 Print 'n' Plotter Jotter and Film*. For ZX81 owners these are available by direct mail or through a growing number of retailers and compshops.

The ZX81 Jotter is a 100 page Graphics pad that exploits to the full the graphics facilities of that micro. ZX81 Film is a matt film version of the Jotter which is re-usable and ideal for 'copying' graphics.

Our manual: *"ZX Graphics programming made easy"* explains everything you need to know about using the ZX81 products, and when used in conjunction with the Spectrum cassette will prove to be the definitive guide to the subject.

And for ZX users (whether Spectrum or ZX81) we still market Printer Paper at £1 less than Sinclairs!

Why not write and place your order today? Graphics can be a very serious subject . . . Print 'n' Plotter products can make it easier . . . and better in a hundred ways you never thought possible!



An illustrated leaflet is sent with all orders. If you require a copy before ordering write enclosing a first class stamp.

To: Print 'n' Plotter Products (Y), 19 Borough High Street, London SE1

Please forward me the following products:

. . . . . ZX SPECTRUM JOTTERS @ £9.95 each.
. . . . . ZX81 JOTTERS @ £3.50 each.
. . . . . ZX81 PLOTTER FILMS @ £2.25 each.
. . . . . "GRAPHICS PROGRAMMING MADE EASY" MANUALS @ £1.50 ea
. . . . . PACKS OF ZX PRINTER PAPER (5 ROLLS) @ £10.95 per pack.
. . . . . ZX SPECTRUM DEMO CASSETTES @ 60p each.

PLEASE NOTE ALL PRICES INCLUDE POST, PACKING AND VAT FOR U.K. DELIVERIES (Overseas should add 25% for additional Surface Mail)

Remittance enclosed payable to Print'n'Plotter Products.
Please bill my Access/Barclaycard/Visa/Mastercard No:–

Name: . . . . . .

Address: . . . . . .

. . . . . .

. . . . . .

Print'n'Plotter Products©

Most Print 'n' Plotter products are available 'over the counter' from the following retailers: • Specialist branches of W.H. Smith • Buffer Micro Shop Streatham • Microware Leicester • Denny's Booksellers London EC2 • Georges Bookshop Bristol • Also represented in U.S.A., Canada and South Africa.

(continued from page 37)
likes of Pac-Man is scaring the hell out of our enemies."

Beyond 1993 the possibilities become more exotic — home computers which could in some way be described as alive. Plant matter will reappear in micros for the first time since Commodore gave up making Pets in wooden cases. The American bio-technology company EMV Associates hopes to produce biochips by the end of 1983. Using an electron beam EMV plans to deposit microscopic circuit designs on to protein. As the circuits will operate in three dimensions they have a potential capacity 10,000 times greater than their silicon equivalents.

It is not only the materials of which the insides of the computers are made which may become more biological. Technologies which begin to look more like the organisation of living creatures than machines are being developed.

Human beings have a nervous system made out of components which are inherently much slower than those of a computer but because of the way that the system is organised even the most powerful computers may never be able to compete with human beings in reacting intelligently to stimuli if they have to cope with inputs serially.

Parallel processing could speed up computers by many orders of magnitude and make them easier to interface to the real world. Parallel processing has always proved impossibly difficult to implement up to now but one British researcher expects to demonstrate a working system this year.

In Japan biological computers are taken seriously enough to form part of the plan for a fifth generation of computers. The Research Development Corporation is funding Hiroshi Shimuzu who has coined the term bioholonics, or the study of self-organising life phenomena, to describe his research. Many experts predict that by the end of this century computers will need to combine biological organisation with biological materials. ■

Is there life in biochips?

The concept of a living, self-replicating, computer existed in the realms of science-fiction long before companies like IBM and Genex began to intimate that a microchip with a biological, rather than a purely chemical basis, was a possibility under serious research.

A team at Warwick University, headed by theoretical physicist John Barber, is working on a biochip design that could be implanted in the human body. It would monitor minute changes in the calcium ions as a result of heart muscle action, thus providing early warning of a heart attack.

It may one day be possible to use chips to correct electrical signals in the human body, sorting out damaged nervous systems. After serious operations, such as open-heart surgery, or where the patient is under intensive chemotherapy, it is useful to monitor the body's potassium balance as this is linked to neural disorders. Since potassium produces ions in electrolysis a microchip could be implanted to perform the function of an electrode, thus measuring the level.

What does Dr Robertson of Edinburgh University, recipient of a £1.78 million SERC grant for microchip research think of the "natural" biochip? "That technology will add something new to our capability. The interesting thing will be to see the integration of our new organic materials with straightforward silicon material."

While Dr Robertson is involved with the straightforward silicon materials, Professor Gareth Roberts and Dr Mike Petty at Durham are in the forefront of making Langmuir Blodgett films — a basic technique in biochip technology.

To make a Langmuir Blodgett film, first take a long-chain organic stearic acid with a carboxyl group of molecules at one end and a methyl group at the other. A soap film is a good example. Put it on the surface of water and the carboxyl group floats — the other end sinks. So the film's molecular chains point upwards. By applying lateral pressure you can form a raft. This can be pulled off on a substrate, making a chip which is thinner and more efficient than the all-silicon ones — the film is only one molecule thick.

The departure from silcon is significant. Silicon oxidises easily, hence its current popularity for microchip construction when compared with more trickly substances like gallium arsenide or indium phosphate. But if these Langmuir Blodgett techniques are successful they may sound the knell for the seath of silicon.

CABEL electronic

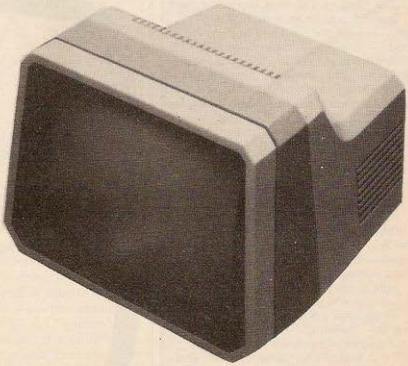
CABEL ELECTRONICS LTD.,
MOUNT ROAD, BURNTWOOD,
WALSALL, STAFFS WS7 0AX
Tel: 021 308 7075 TLX: 339671

MC 370M R.G.B. COLOUR MONITOR
14" Colour Monitor with a full 2 year guarantee, moulded in a stylish cabinet to match your computer.

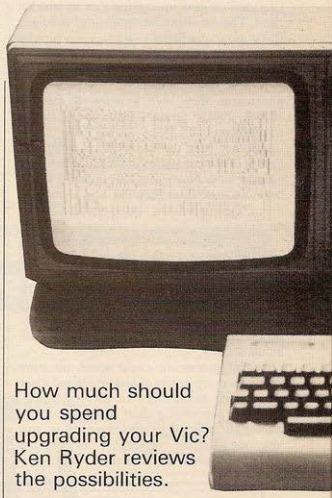
The Advantages of Pure R.G.B.
- 80 × 25 Charictor display
- Crisp definition on colour graphics
- Degaussing facilities
- Permanent link to your computer
- 3 × the band width of your normal TV

CABEL ELECTRONICS LTD., are manufacturers of a complete range of colour and monochrome monitors with 10 years of experience within the television industry, our 2 year guarantee proves our faith in our products.

REC. RETAIL PRICE £289.00 inc. VAT & Postage
See us at the Which Computer Show stand No. V23
Ring us for immediate delivery, most major credit cards accepted.



VIC-20 ADD



How much should you spend upgrading your Vic? Ken Ryder reviews the possibilities.

IF YOU WANT to upgrade your Vic-20, expanding the memory must be a priority. A screen expansion and some aids to programming in Basic and machine code are also often near the top of Vic-owners' shopping lists once they have tired of cartridge games.

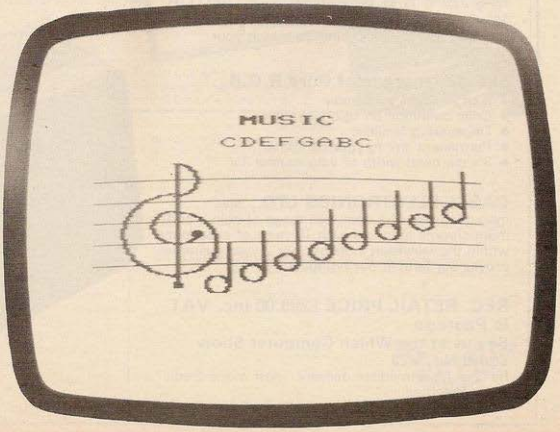
With the Commodore expansion system a 3K, 8K or 16K memory pack can be plugged directly into the back of the Vic to give a maximum on-board memory of 21K, 19.5K of which is available for Basic programs. In order to expand to 32K a motherboard with six expansion slots can be plugged into the back of Vic allowing the 3K, 8K and 16K cartridges to be used together. This leaves three slots available for utility cartridges such as the programmer's aid, machine-code monitor, and games packs.

When the Vic has been fully expanded to 32K only 27.5 is available for Basic programs because the area of memory occupied by the 3K RAM pack is no longer used. However, it is still available for storage of machine-code programs, and for Peeking and Poking values to, so you could store an alternative character set or several screens of information there.

One of the main criticisms of the Vic is its 22×23 screen display, and a 40-column option has been long awaited. The Beebox was one of the first attempts, but was expensive and the manufacturer has now gone out of business. Stack Computer Services has stepped into the breech with a 40/80 column × 25 row monochrome card.

As soon as Commodore's Super Expander cartridge is plugged in you have 3K of extra RAM. The function keys assume eight single keystroke commands, which you can redefine if necessary. Nine new Basic commands are available for plotting and colour control. Eighteen commands become available for the production of sound and music, and seven for reading values of sound and colour registers, including inputs from devices connected to the games port such as joysticks and light-pens.

The pre-assigned function-key commands



Super Expander commands

Auto — displays and increments line numbers automatically. The user can specify the starting line number and the interval between lines, if not then the starting line defaults to 100 and the interval to 10.

Renumber — automatically renumbers all the program lines including the Goto and Gosub references, starting at the line number specified and at the increment set by the user.

Delete — can delete a single line, or all the lines specified between a starting and finishing point, or all the lines from a starting point to the end of the program.

Find — searches the program for a specified Basic command, character, or character string, and displays all the lines in which it appears.

Change — searches for a Basic command or character string and replaces it with a new command or string.

Edit — changes from program mode to edit mode, which alters the function key commands.

Key — allows the user to alter the commands assigned to the function keys. The information assigned to any one key must be 10 characters long or less, and an automatic carriage return can be included in the function.

Help — displays the line in which an error has occurred during program execution and highlights the error in reverse characters.

Dump — displays all the variables and their values in the order in which they were defined, except those in arrays. The value of a variable can then be changed by over-writing it.

Trace — displays the program line number as it is being executed in a small window at the top right-hand corner of the screen. The Shift or Ctrl keys slow down the display if it is too fast. This is useful for finding infinite loops within a program.

Step — halts the program after each program instruction, displays the line numbers associated with that instruction and the first line number of the next instruction. The Shift or Ctrl keys cause the next instruction to be executed.

Off — cancels the Trace and Step modes.

Prog — changes the assignments of the function keys to normal Basic commands.

Merge — loads a previously stored program or subroutine from disc or cassette and incorporates it into the program already in the Vic's memory.

Kill — cancels the functions of the cartridge, but leaves the assignment of the function keys unaltered. It is necessary to inhibit the cartridge during normal program operation because memorising information for diagnostic messages such as Help increases execution time.

Ctrl A — scrolls up a listing.

Ctrl Q — scrolls down a listing.

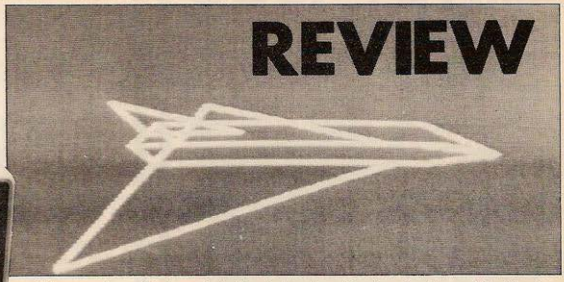
Ctrl L — blocks out all the characters to the right of the cursor on a line.

Ctrl N — blocks out all the characters on the screen after the cursor.

Ctrl U — blanks out the line on which the character is positioned.

Ctrl E — inserts information between quotation marks on a program line.

-ONS



are Graphic, Color, Draw, Sound, Circle, Point, Paint and List. These may be changed using the Key command to any 128-character string, including a carriage return if required. If you do not want to use those graphics commands in a program, the function keys could be used to enter standard Basic commands instead such as Next, Goto, Print, and Gosub.

Unfortunately, the cartridge does not use the highest resolution available on the Vic, 176 × 184, but reduces the screen area slightly to 20 rows by 20 columns, giving a maximum resolution of 160 × 160. Presumably Commodore did this to reduce the screen memory overhead. Then for some reason they divided the screen into a 1024 × 1024 co-ordinate system with its origin in the top left-hand corner of the screen. As there are only 160 × 160 possible plotting positions this means that several co-ordinates occupy the same pixel.

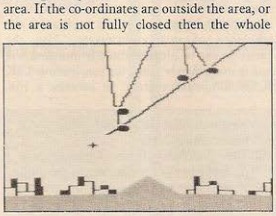
Graphic selects one of the four graphics modes. These are: normal text, medium resolution, 80 × 160, multi-colour graphics allowing any of the 15 colours on the Vic to be used, high-resolution mode, 160 × 160, allowing only the eight keyboard colours to be used, and high-resolution multi-colour mode which allows the mixing of the high-resolution and medium-resolution multi-colour options. All of the modes except normal text require 3K RAM for the screen.

There are four colour registers available and a number from 0-15 can be stored in each, specifying a colour. Register 0 holds the screen colour, register 1 holds the border colour, register 2 holds the character colour used for plotting points and register 3 holds the auxiliary colour which also can be used for plotting, but only in multi-colour mode. The Color command sets the values for these registers.

Point plots a point on the screen at specified co-ordinates. Several points can be plotted using a single Point command, but all will be the same colour. The colours available and resolution depend upon the graphics mode selected. Region changes the character colour, register 2, to any of the eight keyboard colours in high-resolution mode, or any of the 16 colours in multi-colour mode.

Draw plots a straight line from one set of co-ordinates to another, for as many points as can be specified in an 88 character line. It can also be used to plot lines from the finishing points of previously drawn shapes and circles. Circle is an extremely powerful command allowing the user to draw circles, ellipses and arcs on the screen.

Paint fills an enclosed area with a colour starting at specified co-ordinates within the area. If the co-ordinates are outside the area, or the area is not fully closed then the whole



screen will be painted. Again the colours available depend upon the graphics modes.

Char permits strings of text to be displayed on the screen whilst in high-resolution or mixed mode. This facility is not available in medium-resolution multi-colour mode. ScnClr — clears the graphics screen.

The number and range of colours available in each graphics mode is a little complicated. The screen consists of 20 × 10 double-height blank characters, and there is a colour block associated with each character. In multi-colour mode medium-resolution plotting can be performed in any of the colours specified in registers 1, 2 and 3 against the background colour of register 0 and any of the 16 colours can be entered in each register. Thus four colours can appear on the screen at one time.

In high-resolution mode plotting can only be performed in the character colour registers, and only the eight keyboard colours can be used. During a program the character colour can be changed using the Region command, but if two points of different colours try to occupy the same colour block such as two lines intersecting, some interference will occur. With careful programming it is possible to use all eight colours on the screen at one time.

In high-resolution mixed mode only registers 0 and 2 can be used for plotting, and all 16 colours can be specified. If the colour set in register 2 is one of the keyboard colours, all points will be in high resolution. If it is one of the other colours, plotting will be in medium resolution. Again if points of different colours or resolutions try to occupy the same colour block some interference may be produced, but with care it is possible to use all 16 colours on the screen at one time.

The music capabilities of the Vic are greatly enhanced by the Super Expander cartridge. The Sound command controls four voices and their volume, and can be used to produce two or three note chords. Each voice is allocated a three-octave range, which at first sight appears to give nine octaves. However some of the octaves overlap giving a five-octave range.

Entering Music Mode with the Ctrl and □ keys, converts keys A, B, C, D, E, F, G, #, $, P, Q, V, S, O, R. into musical commands. Keys A-G play the natural notes A-G. If # is pressed before the note a sharp is played, if $ is pressed before the note then the note is flat. V controls the volume of the note and R is a rest or silent period. The duration of the note or rest is determined by tempo, T. Any of the four "voices" can be chosen with S, and any of the three octaves in its range with O. S302V5T9# A, plays A sharp of voice 3 in octave 2 at volume 5 for time 9; approximately 4 seconds.

All of the musical commands can be displayed on the screen by entering P, and this can be cancelled by Q. These commands can be entered directly at the keyboard, or they can be combined in a string and executed by a Print statement within a program.

There are also several commands which can be used to read the colour and sound registers, or test the condition of various peripherals

(continued on next page)

(continued from previous page)
that can be plugged into the games port. Rgr reads the mode set by the Graphic command and Rcolr reads the values of the registers set by the Colour command. Rdot reads the colour of any point on the screen and Rsnd reads the values of the four voice registers and their volume as set by the Sound command.

Rpot reads the values of any paddles or potentiometers connected to the user port and returns a number in the range 0-255. Rpen reads the X, Y, position of a light-pen on the screen and Rjoy reads the position of a switch-type joystick and its fire button.

Documentation consists of a 22-page booklet which describes each command complete with a small programming example. If you are thinking of buying a 3K expansion pack and want to use your Vic for graphics and sound, spend an extra £5 and buy the Super Expander cartridge — it is well worth it.

The Vic-20 Programmer's Aid Cartridge is a useful tool for writing, editing and debugging Basic programs. When first plugged into the Vic or expansion board it has no effect and must be initialised to gain access to the extra commands. This is achieved by Typing SYS28681 followed by the Return key. Those of you familar with the Vic memory map will realise that the area starting at location 28681 normally resides in an 8K block of RAM, if fitted. If you have a fully expanded Vic the last 8K block of RAM will be unavailable when using the Aid cartridge, allowing only Basic programs of 19.5K or less to benefit from it.

After initialisation the cartridge is in program mode and the function keys are assigned 12 useful Basic commands such as Goto and Gosub. Normally only eight function keys are available, the other four, F9-F12 are obtained by holding down the CTRL key and pressing the function keys. The Edit mode is entered by typing Edit, or by pressing the Ctrl and F1 keys together. In this mode the function keys are assigned special editing commands, which cannot be included in Basic programs such as Delete, Find and Step.

The function keys simply allow single-keystroke entry of commands and do not limit the commands available. The user can even as sign his own commands to the function keys if desired using the Key command.

The cartridge comes complete with a 15 page instruction book describing each new command, together with a short programming example. The final section uses a dice-throwing program as an example of how to write and debug a Basic program using the features of the cartridge.

Anyone writing long complicated Basic programs of 19.5K or less will find this cartridge invaluable. The time and effort saved in program development could soon cover the cost.

Vicmon as the cartridge is affectionately referred to in the documentation, is similar to the Programmer's Aid, except that it simplifies the writing and debugging of assembly language programs rather than Basic. Typing SYS24576 followed by a Return initialises the cartridge, again the last 8K RAM block is occupied by Vicmon.

The function keys are not assigned any values. Upon initialisation the screen displays the contents of the 6502 registers, that is the program counter, status register, accumulator, index register X, index register Y and stack pointer. The commands offered are single characters followed by various parameters such as start or finish addresses, op-codes, operands and hex values. In fact all operands must be preceded by $.

Vicmon should not be confused or compared with a full assembler/editor. It is a simple aid for the production of short machine-code programs or subroutines. For anyone who has tried hand assembly and a Basic loader for machine code this cartridge is heaven sent, reducing nervous breakdowns to a minimum. Although as all operands must be entered in hex, a decimal to hex conversion command would have been welcome, but I suppose you can't have everything.

At £35 this cartridge appears expensive when compared with some cassette-based assemblers, however, you are paying for the reliability of quality firmware. Also the cartridge can be plugged directly into your Vic and is immediately ready for use, leaving 3.5K RAM for your program. In contrast a 16K RAM pack may be required to load a good software assembler.

The documentation assumes the same layout as the previous cartridges. It is aimed at the reader who is familar with 6502 assembly language, but not an expert. The cartridge commands are presented in alphabetical order, leading to some page flicking, as some of the earlier commands refer to others further on in the text. Some important information, although obvious, is missing. For instance the M command can be used to create word tables or blocks of data as well as editing them; an example of the format required for each form of addressing would be beneficial; for conditional branching only the address to be branched to need be specified, this is only implied in an example; all two-bit addresses are entered MSB,LSB rather than LSB,MSB as in some assemblers.

Stack's 40-column card plugs directly into the back of the Vic or any expansion-board slot, and comes complete with its own video chip to control the display, 2K RAM for the screen memory, and the normal Vic/Pet character set in ROM. The card uses the Autostart facility of the Vic and if no action is taken at power-up the display is automatically in 40-column mode. Various key combinations during power-up will obtain the 80-column or normal Vic configurations. The display can be changed at any time, either directly from the keyboard or under program control.

The card comes complete with monitor and UHF output sockets, either of these together with the Vic's normal UHF output can be used to drive two separate televisions or monitors. For example a program listing or a table of results can be displayed on the 40/80-column screen whilst a graph is plotted on the other.

The card also offers a couple of other useful features. The screen can be set to give automatic line spacing, and if the normal Vic screen is not required the 1.5K memory normally allocated can be used for Basic program storage, also the lower 3K of RAM can be used for Basic giving the Vic a true 32K expansion potential. Obvious uses are word processing, communications, business applications and education.

CONCLUSIONS

- Commodore's cartridges are well presented and constructed, the firmware is professional and bug-free.
- The approach of the documentation is far superior to that of the Vic-20 user manual, including contents, introduction, examples, summary and indices, but the demonstration programs could be better.
- The Super Expander Cartridge offers good value for money and should be purchased in preference to a plain 3K RAM pack. It would be a great advantage if the Super Expander functions could be included with 16K RAM instead.
- The Programmer's Aid offers many useful editing and debugging features, but can only be used to develop programs up to 19.5K in length. This limitation may well restrict its market.
- The Machine Code Monitor will appeal to anyone wanting to develop short assembly language programs. It falls nicely between the two extremes of hand assembly/Basic loader, and a full assembler/editor. The cartridge limits the maximum possible program RAM to 22.5K but this should be no real restriction to assembly language programs.
- Stack's 40/80-column board is a welcome addition to the Vic range of accessories. However, the cost, monochrome display and inability to give high-resolution graphics, 320 × 192, may fail to appeal to the home user market.
- Vic owners should consider their expansion plans carefully. If you are only interested in Basic programming and do not require high-resolution graphics, it seems pointless to buy a 3K RAM pack as it will not be available for Basic when expanding above 6.5K.
- Expanding above 19.5K may be a waste of money and RAM if you want to use the Programmer's Aid, because the top 8K of expansion area is occupied by this cartridge when in use. If you are only interested in assembly language then Vicmon may be all you need, plugged directly into the back of your Vic the 3.5K on board will go a long way.
- The Programmer's Aid, Super Expander and Machine Code Monitor each cost £34.95, 3K of RAM costs £29.95 and the Stack 40/80-column card costs £115. ■

BBC MICRO INSTANT MACHINE CODE!

Yes, it's true. Instant machine code from a good subset of BBC BASIC. Type your BASIC program into your model B BBC Micro, trigger the compiler, and your program is changed almost instantaneously into superfast machine code.
For £34.95 you get: Cassette version of the complete compiler (along with a version of the compiler for use with discs, ready for when you upgrade, the disc version being dubbed on the cassette after the cassette version); complete compiler listing; extensive documentation and instructions. The compiler was written by Jeremy Ruston.

THE BBC MICRO REVEALED

By Jeremy Ruston

'. . .destined to become the bible of all BBC microcomputer users. . .' (Personal Computing Today). If you've mastered the manual, then this book is for you. Just £7.95

LET YOUR BBC MICRO TEACH YOU TO PROGRAM

By Tim Hartnell

'. . .takes you further into the cloudy areas of the BBC machine than anything else I've yet seen. . .' (Computer and Video Games). If you're just starting out in the world of programming, then this book is the one for you. Forty complete programs, including Othello/Reversi, Piano and a host of dramatic graphic demos. Just £6.45

Interface, Dept.YC
44-46 Earls Court Road, London W8 6EJ
Please send me:

( ) INSTANT BBC MACHINE CODE–tape and book–£34.95

( ) THE BBC MICRO REVEALED–Ruston–£7.95

( ) LET YOUR BBC MICRO TEACH YOU TO PROGRAM–Hartnell–£6.45

I enclose £

Name .....

Address .....

SPECTRUM

Make the most of your Spectrum, with these acclaimed books from the experts!

PROGRAMMING YOUR ZX SPECTRUM

Tim Hartnell and Dilwyn Jones

More than 100 routines and programs, 230 pages, and value for every Spectrum user. Learn how to make the most of user-defined graphics (with a Pacman-like program, DOTMAN), sound, colour, and such commands as ATTR, SCREEN$ and BRIGHT. From the co-ordinator of the National ZX Users' Club, Tim Hartnell. Just £6.95.

THE SPECTRUM SOFTWARE LIBRARY

60 GAMES AND APPLICATIONS FOR THE ZX SPECTRUM!

By David Harwood

Arcade games, intelligent board games, brain games and utility programs. They're all here in this massive collection of 60 tested programs for the Spectrum, compiled by Interface columnist David Harwood. Just £4.95.

Interface,
Dept.,YC
44-46 Earls Court Road, London, W8 6EJ
Please send me:

( ) PROGRAMMING YOUR ZX SPECTRUM–£6.95

( ) THE SPECTRUM SOFTWARE LIBRARY–£4.95

( ) A sample issue of INTERFACE, the monthly magazine published by the National ZX Users' Club–£1.00

I enclose £

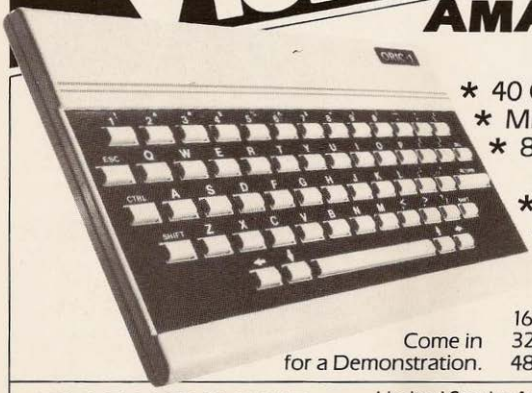
Name .....

Address .....
.....

South London's Largest MicroComputer Centre

VISION STORE

THE AMAZING ORIC-1 Colour Computer



* 40 Columns × 28 rows.
* Microsoft Basic Language.
* 8 Foreground + 8 Background Colours.
* Built-in Sound Synthesiser.
* High Res Graphics.
* Teletext-Prestel Compatible.

Come in for a Demonstration.

16K Microsoft Basic	Phone!
32K Microsoft Basic	**£139.95**
48K Microsoft Basic & Forth	**£169.95**

DRAGON 32K

— Limited Stocks Available.
New Software coming in all the time.

New Vic Software

Krazy Kong!
Dodge Kong's barrells as you climb the stairs.
STD VIC. Joysticks. **£6.99**

Exterminator!
Blast the centipede while dodging the spider amongst the toadstools. Fast action.
STD VIC. Joysticks. **£6.99**

Anti-splatter-matter!
Make space invaders look like childs play, superb graphics. STD VIC. Joysticks. **£6.99**

Vikman
Choose one to three ghosts.
STD VIC. Joysticks **£6.99**

Escape (Labyrinth)	**£6.99**
Dodge Cars	**£6.99**
Bomber	**£6.99**
Invasion	**£6.99**
Raceway	**£6.99**
Alien Panick	**£6.99**
Quirck	**£6.99**
Target	**£6.99**
Search	**£6.99**
New EMI Cartridges	
River Rescue	**£24.95**
Music Composer	**£24.95**

Send for VIC price list.

New Atari Software

Shamus	C/D	**£21.80**
Preppie	C/D	**£19.95**
Beta Fighter	C	**£18.50**
Mouskattack	D	**£31.50**
Hazard Run	C	**£21.50**
Jumbo Jet Pilot	Rom	**£35.95**
Golden Gloves	C	**£20.50**
Pacific Coast Highway	C/D	**£21.80**
Canyon Climber	C/D	**£21.80**
Choplifter	D	**£25.50**
My First Alphabet	D	**£29.95**
Rasterblaster	D	**£22.95**
Submarine Commander	Rom	**£35.95**
Slime	C/D	**£21.80**
Rearguard	C/D	**£15.50**
Micropainter	D	**£25.50**
Shooting Arcade	C/D	**£21.80**
Protector	D	**£21.80**
Nautilus	C/D	**£21.80**
Chicken	C/D	**£21.80**
Frogger	C/D	**£31.50**
Crush, Crumble, Chomp	C/D	**£22.95**
Temple of Apshai	C/D	**£30.95**
EMI Darts	C	**£19.95**
EMI Soccer	Rom	**£29.95**

All Prices Inc. VAT.

COMMODORE VIC-20

5K £137.95*	5K+16K £185.95*	16K £199.95	32K £249.95
inc. basic	inc. basic	Less Basic	Less Basic

*includes 5 Free programmes.

Vic Cassette **£44.00** Vic Disk Drive New
Vic Printer **£229.00** Low Price **£299.95**
16K RAM Pack **£49.95**

New

Commodore 64
64K Colour Computer
in stock now **£345**

Main Commodore Dealer for: New 500 series
New 700 series
Business Computers.

Sinclair ZX81 £49.95

Cased typewriter keyboard **£29.95**
16K RAM **£29.95** Printer **£59.95**

We offer excellent part exchange deals or cash for your old machine.

ATARI 400

Basic Cartridge £34.90

Atari 800 16K inc. Basic	**£399.00**
Atari 800 48K	**£469.95**
Atari 410 Cassette	**£49.00**
Atari 810 Disk Drive	**£299.00**
Atari 822 Printer	**£199.95**

Plus Daisy Wheel and Dot Matrix printers for the Atari range.

New

Atari 400
Typewriter keyboard.
Direct easy replacement for standard keyboard
£78.95

Now available
EMI Submarine Commander.
EMI Jumbo-Jet Lander.
Incredible Games for Atari.

Over 900 software programmes always in stock. We carry probably the widest range with continuous demonstrations.

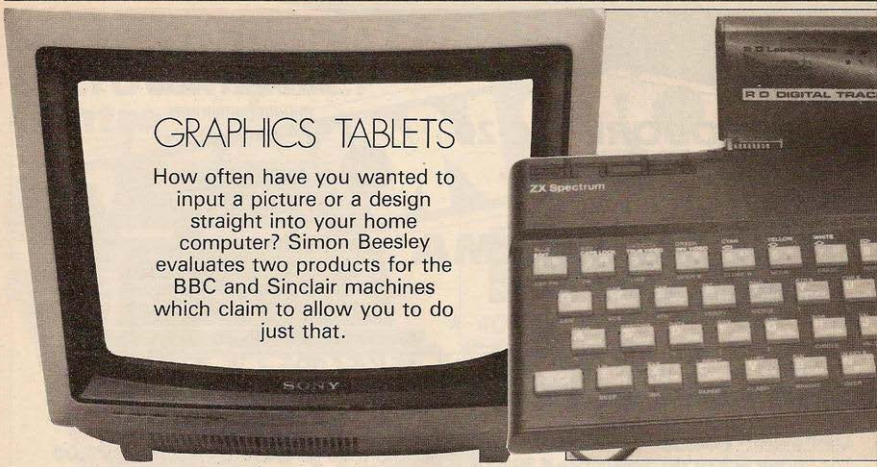
Mail Order — send for our comprehensive list.

All Prices inc. VAT.

Instant Credit Available subject to status

Access/ Barclaycard

VISION STORE **3 Eden Walk Precinct, Kingston-on-Thames, Surrey. Tel: 01-546 8974**



GRAPHICS TABLETS

How often have you wanted to input a picture or a design straight into your home computer? Simon Beesley evaluates two products for the BBC and Sinclair machines which claim to allow you to do just that.

GRAPHICS TABL

THE RD DIGITAL TRACER enables pictures to be drawn or copied to the Spectrum's screen. It consists of a mechanical arm which is hinged at the base and the middle and can be mounted on a drawing board. At each joint of the arm there is an angular transducer. Signals sent by the transducers are digitised by an interface board, plugged into the rear of the Spectrum. The board has a connection to take a ZX Printer or Microdrive.

The kit also includes a software cassette, an instruction booklet, a tracing sheet and a template for aligning the tracer with the tracing sheet.

Drawing program

Once you have loaded a drawing program you can transfer a picture to the screen by moving the head of the tracing arm.

Probably the most important question to answer is how easy is it to transfer an outline to the screen accurately. The tracer picks up movements within an area 30cm. by 20cm. Since the Spectrum's resolution is 255 pixels by 175 this gives just over a millimetre per pixel. The arm certainly responds to movements this small, but achieving an exact screen copy depends more on how much fine control the arm's action allows.

As with a joystick, the problem is to strike a balance between too much give and too much resistance: few people can manage to control a joystick steadily if it moves too freely, and, on the other hand, too stiff an action is equally likely to result in jerkiness.

The RD Tracer scores quite highly in this department. Although the action is fairly free you can steady its movement by putting pressure on a pencil inserted in the tracing head.

Four programs are included on the software cassette, which can be used alone or merged together. The main drawing program provides a number of plotting options and also allows you to use Spectrum Basic's plotting functions. Single-letter entries allow you to plot individual points or draw a continuous line, change the background or foreground colour, delete lines and print text. Among the other options is a facility for filling in or shading the area enclosing the tracer. The position of the tracer on the screen can be indicated by a small or large crosswire.

You can draw a circle using the Spectrum's Circle command and define the centre and radius through the tracer position. The Spectrum's facility for saving the screen to tape is also available.

The plotting modes

These and other plotting modes enable you to copy a picture to the screen as closely as the Spectrum's resolution and colour range permits. But putting a detailed colour picture on the screen could be a lengthy process. The programs are written in Basic and some of the routines are rather slow.

For example, keyboard entries are not detected instantly and filling an enclosed area can make demands on your patience. Bursts of

SURVEY

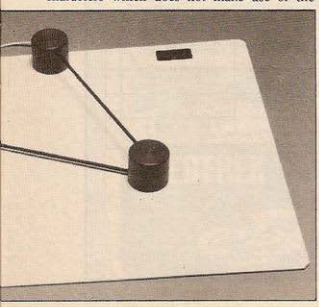
ETS

rapid sketching are too much for the tracer to copy faithfully.

This is a software, not a hardware, problem. To be fair, the routines RD Laboratories supplies are adequate but machine-code versions would make the tracer much more effective.

The software cassette also contains a program which prints the x and y co-ordinates of the tracer at the top of the screen as it moves and allows the origin and scale of the plotting co-ordinates to be changed. The third program provides a blind-drawing facility; points can be inputted at greater speed than normal and are then drawn at a slower speed.

Lastly, there is a program to design characters which does not make use of the tracer and which is given free to the buyer.



While the tracer has an obvious use in schools and could perhaps even find a place in an office, RD Laboratories say that they have taken at least 50 percent of their orders from home users.

At a price of £49.95, inclusive of VAT and postage, this is the first such device to be produced which is suitable for low-cost micros.

It will also work with the ZX-81 and two short programs are included for this purpose but the ZX-81's limited screen resolution gives it only a limited application.

Software support

RD Laboratories intends to support the tracer with more general-purpose and specialised software packages. Details from 5 Kennedy Road, Dane End, Ware, Hertfordshire SG12 0LU. Telephone: 0920-84380.

Micro Management's Graphics Tablet for the BBC Model B comes ready-mounted on a Perspex board measuring 70 by 56 cm. Like the RD Digital Tracer the tablet has two cylindrical hinges at the base and the centre. Both the central hinge and the tracing head rest on the board which is covered with a Cellophane sheet to permit them to slide freely.

This is a rather more substantial piece of equipment than the Spectrum tracer but can be moved around the board with equal steadiness.

The manual warns that on early models of the BBC wavering might occur around the screen cursor point when drawing. The explanation is that the power pack and other components produce interference.

Wavering certainly occurred on one of the BBC Micros used but cleared up completely on a later model. The company suggests that if the problem persists after you have consulted a dealer you might like to buy their "splendid external converter" which should cure it.

While the hardware appears to be well designed the graphics tablet is poorly served by the software that accompanies it. A program is supplied on cassette and provides many of the same drawing options as the Spectrum tracer's software. These include facilities for drawing a straight line, filling a shape, changing the colour of the line, printing text and displaying the x and y co-ordinates of the cursor. In addition there are commands to position and draw the x and y axes, and to calculate the area of a shape in terms of a scale and units which have previously specified.

Setting the limits

Before drawing, the user needs to set the limits of the drawing area by moving the arm to four positions in sequence. Alternatively these initial settings can be loaded from tape. Screen pictures can also be saved to and loaded from tape.

These options, however, are not well presented. The program gives the user no indication of which plotting mode it is in; no prompts appear on the screen when an input is expected and the position of the cursor is marked by one barely visible pixel.

The existing set of commands allow the user to copy a picture to the screen fairly easily. But given the scope of BBC graphics and the speed of BBC Basic one might reasonably expect a more sophisticated package. It would not have been difficult to have included options for changing the background colour or drawing with a dotted line. A circle-drawing facility would also be useful.

The program provided is a rather makeshift piece of software which makes little use of some of the best features of BBC Basic. Micro Management might reply that the program is not intended to be more than a sampler. But if that is the case the tablet begins to look rather expensive. It costs £86 which seems a lot for what is essentially quite a simple device.

Unlike the Spectrum the BBC Model B already has four analogue to digital converters on board and BBC Basic supplies the ADVAL function to read the converted digital input from the Analogue In port.

The BBC Graphics Tablet is available from Micro Management, 32 Princes Street, Ipswich, Suffolk. Telephone 0543-59181.

CONCLUSIONS

- Both devices allow a picture to copied to the screen accurately, if rather slowly.
- The Spectrum Tracer's price and light-weight construction make it suitable for the hobbyist and for use in schools.
- Software for the Tracer is adequate but could be greatly improved upon.
- The BBC Graphics Tablet has a more solid design which affords a greater degree of fine control. With appropriate software it could find a wider application, outside the confines of the home and classroom.
- The program supplied with the BBC Tablet is barely satisfactory and scarcely justifies its relatively high cost.

20 BEST PROGRAMS for the ZX SPECTRUM £7.95

Mr HELPLINE — the man who answers your ZX queries in his column in *Sinclair User*, the author of HINTS & TIPS FOR THE ZX80 and HINTS & TIPS FOR THE ZX81 now presents his 20 BEST PROGRAMS FOR THE ZX SPECTRUM.

* 20 original programs for you to load into your Spectrum.
* 20 interesting programs for you to enjoy and learn from.
* 20 great programs to teach you about fixed and variable length records, binary searches, bubble sorts, floating point arithmetic, graphic displays and much, much more . . .
* **20 BEST PROGRAMS FOR THE ZX SPECTRUM.**

Program Titles Include:

Machine code editor — Write, modify, exend and load machine code using this all-Basic machine code editor. No need to use an Assembler when you have this program.

Index file — Learn about fixed length records, save numeric and string fields, add to, sort, modify, delete and print your records. Ideal as a computer based card index.

Duckshoot — Learn how to manipulate the attribute file *and* have fun at the same time.

Diary — Binary searches and variable record lengths are explained with this useful and interesting program.

PLUS: FOOTBALL, DIGITISER, DATA PLOT, FUNCTION PLOT, REGRESSION, HISTOGRAM, LINE RENUMBER and many more.

ZX81 HARDWARE

16K MEMOPAK (expandable)	£29.90
32K MEMOPAK (expandable)	£49.90
64K MEMOPAK	£79.00
56K Ram pack	£54.95
HRG MEMOPAK Hi Res Graphics	£59.80
MEMOPAK Centronics printer interface	£39.90

ZX81 CASSETTES

SPACE INTRUDERS (16K)	£5.95
STATISTICS (1K)	£3.75
LANGUAGE DICTIONARY (16K)	£3.75
LINE RENUMBER (16K)	£4.95
NAVAL BLOCKADE (16K)	£5.95

ZX81 BOOKS

HINTS & TIPS for the ZX81 £3.95

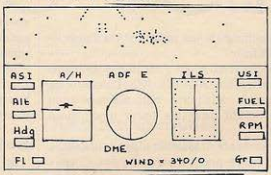
SPECTRUM

ASSEMBLER/DISASSEMBLER £8.95

- Two programs on one cassette
- Comprehensive instructions
- Great value for money

NIGHT FLIGHT £5.95

For the 16K or 48K SPECTRUM



Fly your own aircraft from take off to landing via navigational beacons, over mountains and using a fully detailed direction finding and instrument landing system. *You are the Pilot of a light aircraft flying at night. *You must use your skill and judgment to fly your aircraft accurately over radio beacons and then land safely on the runway *Hazards are mountains and cross winds *Instruments: Artificial Horizon, Non Directional Beacon, VHF Omnidirectional Range, Instrument Landing System *Readouts: Gear, Flap, Air Speed, Distance Measuring Equipment, Vertical Speed, RPM and heading *Visual display of runway on approach *5 Modes from Take off to Autopilot *Happy landings *WRITTEN BY A QUALIFIED PILOT*

Z80 OP CODES £1.45

A must for the beginner and the experienced programmer alike. This hand ready reckoner lists all 600 plus Z80 machine code instructions in decimal and hexadecimal with their mnemonics. Each Op Code is succinctly explained and cross-referenced. Supplied in a protective transparent wallet for easy reference and durability.

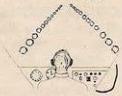
PROGRAMMERS TOOLKIT ZX81 £6.50

Toolkit functions include

* RENUMBER including the destination lines of GOTO's and GOSUB's
* START and Finish lines and Step size specified by you
* DELETE part or all of a program at your command
* REPLACE (characters or tokens) with an equal number of others specified by you
* EDIT to create sub routines at a stroke by moving blocks of basic program lines
* FIND a basic program string specified by you
* INPUT prompts for a two digit hexadecimal code and pokes it at a specified address
* Separate versions available for 48 + 8 and 64K memories (ready at 8192)

PILOT ★ ZX81 £5.95

New and exciting. Motor challenges you to take off, fly between beacons, then land whilst watching wind speed and dodging craggy mountains – either could lead to disaster! If you take the challenge, you may soon learn to fly solo – so treasured are the flying instructions. Coast along in Auto pilot to gain confidence then battle your way through 6 further modes, 6 different ways of trying to steer your plane safely back to base, increasing in difficulty, testing your skills. Good luck with your fight against the unpredictable enemies!



PUCKMAN *NEW!* ZX81 £5.95

* All action display
* Scour the maze for food
* Dodge the ghosts who come to devour you
* Automatic option – the machine plays itself
* Full keyboard display
* Full instruction display
* Continuous scoring
* Beat the best score to date
* Super graphics when used with Quick Silva graphics board

QUANTITY	PRODUCT	COST
	TOTAL	

MAKE CHEQUES/PO's PAYABLE TO: HEWSON CONSULTANTS.

NAME. . . . . .
(block capitals please)
ADDRESS . . . . . .

. . . . . .

My Access/Barclaycard No. is. . . . . .

Signed . . . . . .

Post to: **HEWSON CONSULTANTS, DEPT YC, 60A ST MARY'S STREET, WALLINGFORD, OXON OX10 0EL. TEL (0491) 36307.**

SOFTWARE FOR ALL

SOFTWARE FOR ALL presents programs for the people! Our list of original programs for the BBC, DRAGON, and SPECTRUM is growing every day! Reasonably priced. Ingenious use of programming. Excellent entertainment. These are the hallmarks of SOFTWARE FOR ALL.

Order now for fast delivery or visit one of our dealers. There's big things happening for all computer users . . . That's why we're called SOFTWARE FOR ALL!

PAIRS

A computerised version of the original card game with Hi-Res graphics.

£6.45 DRAGON 32

GALACTIC INTRUDER

BBC MICRO

Fast arcade-type action game with Hi-Res colour and sound. Machine Code. 32K **£6.95**

J.R.

Two player game, features include exploration, drilling, employment and Price Wars. 32K

BBC MICRO **£6.95**

AREA RADAR CONTROLLER

You're in the control tower at Heathrow and it's your job to control up to 79 aircraft, taking off, landing, or just passing through. VERY ADDICTIVE — HIGHLY FRUSTRATING!

DRAGON 32 **£7.95**

POLAR BEAR

Educational game for 8-12-year-olds incorp. simple maths tables.

BBC MICRO 32K **£7.45**

ROW OF FOUR

Try to outwit your computer opponent in this game of skill. Great graphics. BASIC and machine code. 32K

BBC MICRO **£6.45**

PHARAOH'S TOMB

ZX SPECTRUM

3D Maze Game and Adventure rolled into one! 48K

£6.95

SPACE KINGDOM

Battle your way around the Planets to become ruler of the Galaxy! Excellent use of graphics and sound. 32K

£7.95 BBC MICRO

TIME TRAVELLER

Travel through over 100 rooms in different times, and find the key back to your own time. 32K

BBC MICRO **£6.95**

Utility Pack I

£7.45

Envelope program, variable print-text scanner and memory dump. 32K

BBC MICRO

CAR WARS/ALIEN PLANET

Two addictive graphics games both BASIC and Machine Code.

32K **£6.95** BBC MICRO

DANGER ISLAND

DANGER

An adventure game in which you fight your way through many obstacles to escape.

DRAGON 32 **£6.95**

Utility Pack 2

£7.45

Disassembler, program crunch and text editor. 32K

BBC MICRO

ZOMBIE ISLAND

Fight for survival on an island inhabited by hungry, dangerous cannibals. BASIC and machine code program.

BBC MICRO 32K **£7.95**

BEEBTREK

BBC MICRO

Real time advanced Startrek Game. Extra facilities include "probe satellites", "damage reports" & "on-board computer".

16/32K **£7.95**

SEND TODAY! Post to SOFTWARE FOR ALL, Dept YC, 72 North Street, Romford, Essex or Phone: (0708) 60725

Name: .....

Address: .....

Please send me:

£ .....

£ .....

£ .....

£ .....

£ .....

£ .....

Please add £1.00 P&P per order . . . £ 1.00

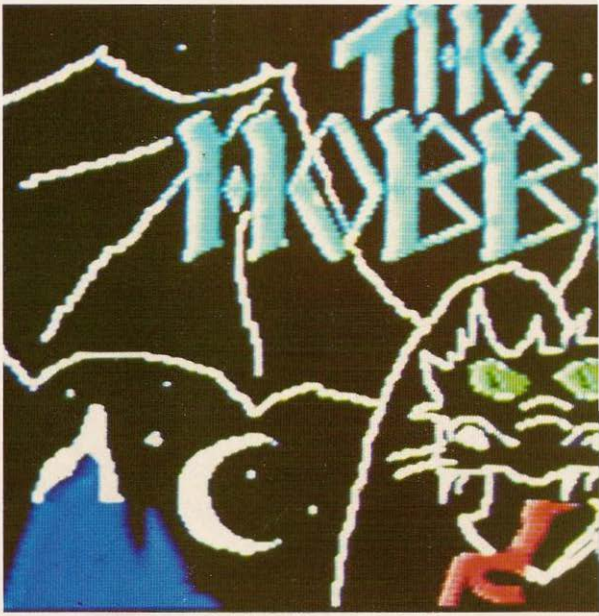
Total: .....

I enclose Cheque/P.O. made payable to SOFTWARE FOR ALL.

Please bill my Access/Barclaycard/Amex No: .....

SOFTWARE FOR ALL

"Programs for the people"



SPECTRUM SOFT

Simon Beesley braves attacks by trolls, bombardment by meteoroids, alien invasions and even English literature to bring you up to date with Spectrum software.

THE QUALITY of Spectrum software has improved since our last survey but originality remains in short supply. Most of the programs looked at are games programs and the bulk of these are modelled on the arcade classics, Space Invaders, Pac-Man, Defender and Asteroids. Perhaps this is because the games-buying public is only interested in games that fall into a recognisable category.

Some of the programs are written entirely in Basic. This need not count against them unless the program displays moving graphics.

The Spectrum's keyboard is not very suitable for fast-moving games although Quicksilva and Softek offer a joystick option on some games.

Sinclair has released a large range of programs written for them by ICL and Psion. By and large the ICL programs compare badly with those from Psion and have a rather amateurish look to them.

Each of the tapes in the ICL games series, Games 1 to 4, contains four short Basic programs with titles such as Galactic Invasion, Skittles and Train Race. These are the sort of programs a reader might like to key in from a listing in a magazine. They are fairly simple and afford a limited entertainment for a short period. In view of their variety each package represents reasonable value although they are perhaps more suitable for young people.

ICL has also produced five titles in a Fun to Learn series covering Music, History, English Literature, Geography and Inventions. They present a variety of quizzes on their respective subjects. Players can compete against each other in a race in which correct answers send them further along the track.

It is difficult to know who these programs are aimed at. One soon runs through the stock of questions and the same names appear in different types of question. Some of the information presented is too obscure or eccentric to make the programs suitable for schools. In the English Literature quiz, for example, Ian Fleming rubs shoulders with Shakespeare and little-known seventeenth century playwrights.

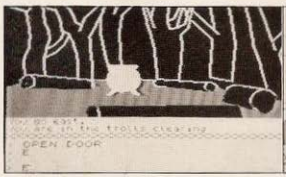
Psion's collection of programs is far more satisfactory. Hungry Horace is loosely related to Pac-Man but has a number of original features. Horace has to eat the flowers in a park while avoiding the park guards. Sinclair gives a fair description of Horace as a subtle and amusing cartoon-style game.

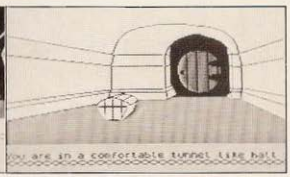
Psion's 48K chess program was written in conjunction with Microgen. It plays a remarkably strong game even at the lower levels. As an averagely competent player I found it quite hard to beat at level two, although its play seemed to come adrift under pressure. The program's response time is quick and the pieces are quite easily distinguished.

Space Raiders and Planetoids are Psion's versions of the arcade games Invaders and Asteroids. Anyone who still has an appetite for these games will find the Psion products more than adequate. With Vu-Calc, Psion has scaled down a Visi Calc-type program to the dimensions of the home micro. These programs, which are commonly used on business micros, are usually described as providing a financial spreadsheet.

They enable the user to lay out financial data in rows and columns and enter formulae to run calculations on parts or all of the table. Vu-Calc supplies a range of commands for entering data, text or formulae and performing calculations.

Basic programs which have been compiled by Softek's compiler, Super C_3 run — typically — 10 times faster. The compiler sits at the top of memory above RAMtop and is unaffected by a New command. It leaves room for a Basic program of up to 8K and a further 10K for





Top and above: The Hobbit. Right: Meteoroids, above right, Fun to Learn, and over page Time Gate.

WARE

data. The present version cannot cope with decimals, arrays or string variables. These limitations need not be too constricting. Strings, at least, can be stored in the data areas as ASCII codes and accessed through Peeks.

At £14.95 this is good value; particularly since it enables people to write commercially respectable programs without having to master machine code. However Softek insists that anyone planning to sell programs created with the compiler should negotiate for the rights. Softek claims that trace elements have been included to detect code written with Super C.

The arcade game Asteroids crops up on almost every micro. Softek's version Meteoroids is one of the fastest for the Spectrum with good colour and sound. Softime supplies the Spectrum with a digital clock and alarm at the top of the screen which remains there while other programs are loaded and running. The last program in Softek's list is Zolan Adventure, a standard text adventure game which has the merit of fitting into 16K.

Quicksilva gave Time Gate considerable advance publicity claiming it would make as great an impact on the computer games' world as had Atari's Star Raiders. As it turns out the game closely resembles Star Raiders. Given that the Atari is a rather more sophisticated computer it is not surprising that the Spectrum version of the game does not match the original.

Time Gate presents a view from the cockpit of a spaceship. An instrument panel below contains a long-range scanner and a variety of other indicators giving information on the ship's position and damage incurred. Your mission is to clear 18 galactic sectors of enemy craft.

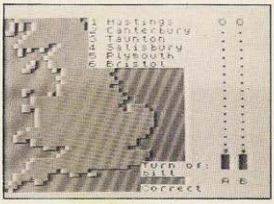
The business of locating and firing on enemy ships is not as interesting as attending to all the other procedures. The controls are not as responsive as on the Atari. Nonetheless this is an elaborate game with excellent graphics — certainly one of the best so far for the Spectrum.

In an impressive piece of synthesised speech Quicksilva's chess program announces itself at the beginning with "this is the Chess Player". Rather startlingly the packaging relates how the Chess Player, an Evil Being, has called for a challenger from Earth. The planet's survival hangs on your game — and you thought you were just going to have a quiet game of chess.

In the event the program plays quite a strong game with the option of six levels of play. The board is clearly displayed and the pieces are well designed. Psion's chess program, however, is probably the better player.

Meteor Storm, another version of Asteroids, also announces itself but rather indistinctly. There is not much to choose between this and Planetoids or Meteoroids. The major problem for software companies writing an Asteroids-

SURVEY

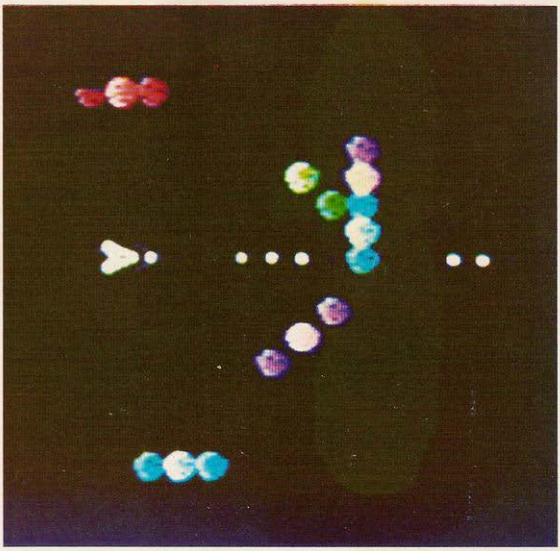


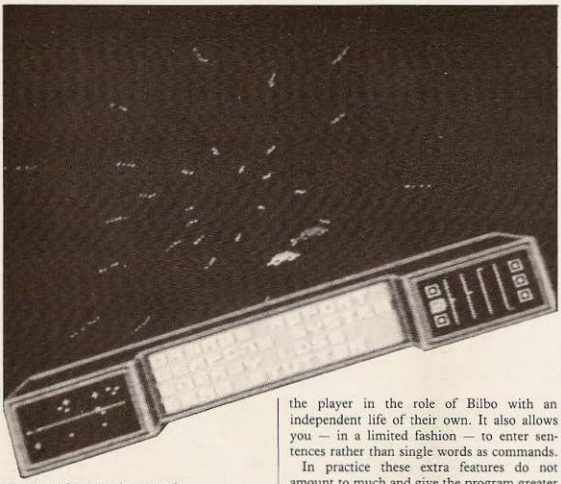
type game must be in finding an alternative title.

Spectres from Bug-Byte gives a novel twist to the Pac-Man concept. Eddie the electrician has to rewire a haunted house. Instead of eating or picking up objects in his path he lays down light bulbs. Reaching one of the four power generators enables him to illuminate the house and drive off ghosts.

The game has a highly individual flavour. The characters which glide around at a fairly leisurely pace, are engagingly different from the standard Pac-Man figures. This is one of the more original games yet to appear for the Spectrum.

Gulpman from Campbell Systems is also based on Pac-Man but refreshingly breaks away from the standard format. It offers a choice of 15 different mazes and allows the speed of play to be set. At the highest levels your little man dashes around the maze at quite a pace. *(continued on next page)*





(continued from previous page)

By contrast Jega's Specman, written in Basic, is dismally slow. Sometimes the ghosts seem to be striken with paralysis and unwilling to take up the chase.

Escape from New Generation Software is a variation on the maze theme which involves escaping from dinosaurs. The dinosaurs — brontosauri, pterodactyls and such like — pursue the player's character with considerable animation through the maze which is shown in bird's-eye view.

Silversoft's games Orbiter and Ground Attack are probably the best Spectrum versions of the arcade games Defender and Scramble. Ground Attack requires the player to fly a plane through a series of caverns and avoid or destroy missile attacks from the ground. Scramble from Work Force is similar but marginally slower. Likewise Avenger — Abacus' version of Defender — is competent but not quite as accomplished as Silversoft's.

Mystery meeting

A gold sundial worth £6,000 is the prize for the first person to solve all the clues in the adventure game Pimania. As in Kit Williams' book *Masquerade*, deciphering all the clues will lead the winner to a meeting at a specific time and place with representatives from the authors of the game, Automata Ltd.

The other side of the program tape contains a disco single. Automata say that the clues are scattered in the music, the program and the graphics. Although we did not proceed very far with the quest the music and opening graphics seemed to bear out Automata's claim that the world of the Pi Man is totally bizarre.

Melbourne House has based The Hobbit, on the novel by Tolkien. It helps to have read the book in finding your way about.

The Hobbit is claimed to be an advance on other adventure games because it introduces other characters from the book who react to the player in the role of Bilbo with an independent life of their own. It also allows you — in a limited fashion — to enter sentences rather than single words as commands.

In practice these extra features do not amount to much and give the program greater scope for the sort of inconsistencies adventure programs are prone to. Thorin, for example, repeatedly enters the scene and tells you to hurry up. This is irritating because you were unaware that he had left and he seems to be totally devoid of constructive ideas. It is not a good idea, however, to kill him off since he sometimes proves too strong for your attack. Furthermore the manual suggests that you should stay on good terms with the other members of your party if you are to succeed in your quest.

Many of the locations in the adventure are illustrated by some excellent graphics. We only managed to complete 7.5 percent of the game during which the text was accompanied by six different pictures. The graphics coupled with a more varied plot than usual make The Hobbit superior to any other adventure games available for the Spectrum.

Both the assemblers tested, from ACS and PI software, require Z-80 mnemonics to be entered in Rem statements and both allow addresses to be replaced by labels. The ACS assembler, Ultraviolet, costs twice as much at £7.50 but offers several extra features. It allows multiple statement lines and provides five pseudo-instructions such as DEFS, which inserts a string of ASCII characters at the current assembly position.

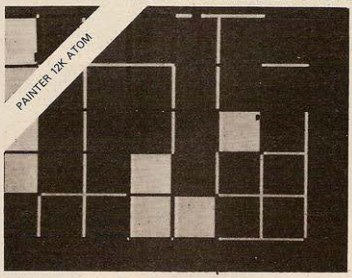
ACS also supplies a disassembler, Infrared. Like the assembler this has two different versions for 16K or 48K machines. The program is easy to use and does all you might expect from it. ■

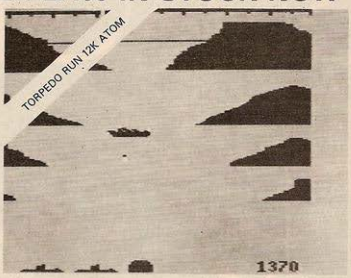
Company	Program name	Memory required	Price
SN	Games 1-4	16K	£4.95
	Hungry Horace	16K	£5.95
	Fun to Learn	16K	£6.95
	Chess	48K	£7.95
	Vu-Calc	48K	£8.95
	Space Raiders	16K	£4.95
	Planetoids	16K	£4.95
QS	The Chess Player	48K	£6.95
	Time Gate	48K	£6.95
	Meteor Storm	16K	£4.95
SF	Super C	48K	£14.95
	Meteoroids	16K	£4.95
	Softime	16K	£3.95
	Zolan Adventure	16K	£4.95
SS	Orbiter	16K	£5.95
	Ground Attack	16K	£5.95
MH	The Hobbit	48K	£14.95
AU	Pimania	48K	£10
WF	Scramble	16K	£4.95
AB	Avenger	16K	£4.95
CS	Gulpman	16K	£5.95
JS	Specman	16K	£5.95
AC	Ultraviolet	16K	£7.50
	Infrared	16K	£6.75
PI	Assembler	16K	£3.75
NG	Escape	16K	£4.95
BB	Spectres	16K	£8

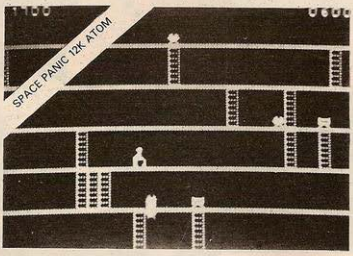
SN	Sinclair Research, Stanhope Road, Camberley, Surrey.	AC	ACS Software, 7 Lidgett Crescent, Roundhay, Leeds LS8 1HN.	WF	Work Force, 140 Wilsden Avenue, Luton, Bedfordshire.
SF	Softek, 329 Croxted Road, London SE24.	PI	PI Software, 18 Pilgrim's Lane, London NW3 1SN.	JS	Jega Software, 27 Hallcroft Avenue, Countesthorpe, Leicestershire LE8 3SL.
SS	Silversoft, 20 Orange Street, London WC2H 7ED.	AB	Abacus Programs, 186 Saint Helens Avenue, Swansea, West Glamorgan SA1 4NE.	NG	New Generation Software, Freepost (BS 3434), Old Land Common, Bristol BS15 6BR.
MH	Melbourne House 131 Trafalgar Road, Greenwich, London SE10.	QS	Quicksilva, 92 Northern Road, Southampton SO2.		
CS	Campbell Systems, 15 Rous Road, Buckhurst Hill, Essex IG9 6BL.	AU	Automata Ltd, 65a Osborne Road, Portsmouth PO5 3LR.	BB	Bug-Byte, Freepost, Liverpool L3 3AB.

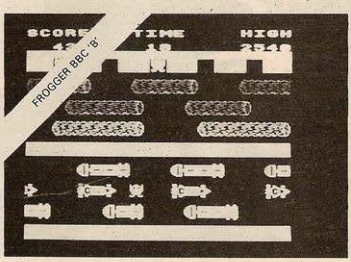
A+F SOFTWARE A+F

* 48K SPECTRUM FROGGER £7.00 IN STOCK NOW*









12K ATOM

Starburst	£5.75
Torpedo Run	£6.90
Cylon Attack	£6.90
Space Panic	£6.90
Painter	£6.90
Zodiac*	£6.90
Death Satellite*	£6.90

WE PAY 25% ROYALTIES FOR HIGH QUALITY PROGRAMS

Hours of enjoyment for all the family featuring fast moving graphics, sound effects and high score tables where appropriate.

BBC MODEL A

Tower of Alos*	£6.90

(above also runs on Model B)

BBC MODEL B

Lunar Lander	£6.90
Early Warning	£6.90
Road Runner	£6.90
Frogger (Machine Code)	£8.00

* Hours of Purgatory with these adventure games — can you get out alive?

****

BBC 'B' BRAND NEW INTERACTIVE ADVENTURE GAME WITH SUPERB GRAPHICS. 'PHAROAH'S TOMB' WILL BE THE BEST £8.00 YOU HAVE EVER SPENT ON AN ADVENTURE GAME.

****

ATOM 'TOOLKIT' EPROM

22 Extra Commands and Five features including 1200 Band Cass. operating System. £18.50

ADD 4 or 6 EPROMS TO YOUR ATOM WITH OUR 'ADDA' BOARDS

4-Way 'Adda' board	£20.75
6-Way 'Adda' board	£28.75

PLEASE NOTE: NO EXTRAS, ALL PRICES INCLUDE VAT AND POSTAGE

TO ORDER BY MAIL: SEND CHEQUE, POSTAL ORDER OR CREDIT CARD NUMBER OR TELEPHONE (24 HOUR ANSWERING) CREDIT CARD NUMBER

VISIT OUR SHOWROOM FOR A DEMONSTRATION OR MAIL ORDER

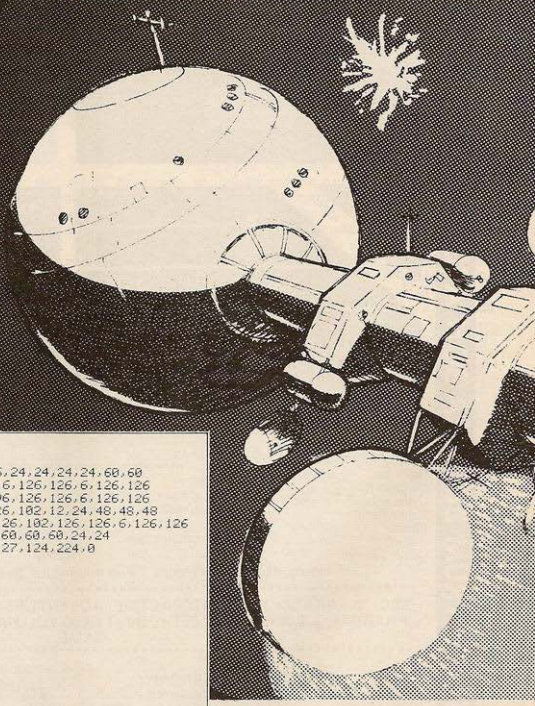
061-223 6206 TELEX: 667461 (Attn. A+F)

830 HYDE ROAD GORTON MANCHESTER M18 7JD

SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM

SPACE RUN

Flee through the cosmos in this engrossing game of pursuit written by David Browne. Malignant alien beings seek tirelessly to destroy your vessel.



```
0 FORI=7552TO7671:READA:POKEI,A:NEXT
1 DATA126,126,102,102,102,102,126,126,56,56,24,24,24,24,60,60
2 DATA126,126,6,126,126,96,126,126,126,126,6,126,126,6,126,126
3 DATA96,96,108,108,126,126,12,12,126,126,96,126,126,6,126,126
4 DATA126,126,96,126,126,102,126,126,126,126,102,12,24,48,48,48
5 DATA126,126,102,126,126,102,126,126,126,126,102,126,126,6,126,126
6 DATA24,24,60,60,60,126,126,66,66,126,126,60,60,60,24,24
7 DATA0,7,62,254,254,62,7,0,0,224,124,127,127,124,224,0
8 DATA0,60,126,171,213,126,60,0
10 PRINT"■■■                    ";
11 PRINT"■ ___________________ ";
12 FORT=1TO20
13 PRINT"■ |                 | ";
14 NEXTT
15 PRINT" ___________________";
16 POKE36879,8:TI$="000000"
17 POKE36869,255
18 POKE8185,160
19 PRINT"■■■        ■"TI$"■     ";
20 GRAPHIC=209:A=7900
21 MINE=160:B=11
22 V=8142
23 Z=5
24 CL=0:POKE36878,15
25 X=8142:SOUND=36876
26 Y=15
27 LC=0
28 C=0
30 KEYS=PEEK(197)
41 IFKEYS=47THENC=1:GRAPHIC=59
42 IFKEYS=39THENC=2:GRAPHIC=58
43 IFKEYS=33THENC=3:GRAPHIC=60
44 IFKEYS=26THENC=4:GRAPHIC=61
45 IFC=1THENA=A+22:POKEA-22+B,160
46 IFC=2THENA=A-22:POKEA+22+B,160
47 IFC=3THENB=B-1:POKEA+B+1,160
48 IFC=4THENB=B+1:POKEA+B-1,160
50 IFA=7702THENC=1:GRAPHIC=59:A=A+22
51 IFA=8164THENC=2:GRAPHIC=58:A=A-22
```

THIS PROGRAM for the unexpanded Vic makes economical use of the user-defined character facility. Fifteen characters are defined in data statements and 10 of these redesign the numbers 0 to 9. It would be easier to read the definitions for numerals from the character set in ROM into RAM — but less pleasing to the eye.

In hot pursuit

The object of the game is to manoeuvre your ship around the screen avoiding two saucers in hot pursuit. Use the keys Z and X to turn left and right, the function keys F1 and F3 for up and down. Watch out for the deep-space mines laid by the pursuing alien hostiles.

```
52 IFB=0THENC=4:GRAPHIC=61:B=B+1
53 IFB=21THENC=3:GRAPHIC=60:B=B-1
54 IFPEEK(A+B)=174THENPOKEA+B,215:GOTO800
55 POKEA+B,GRAPHIC
60 CL=CL+1
65 LC=LC+1
70 IFCL=2THENGOSUB200
71 IFLC=3THENGOSUB500
75 PRINT"■■          ■"TI$"■      ";
76 IFPEEK(A+B)=174THEN800
80 GOTO30
200 KM=INT(2*RND(1))
205 IFKM=0THENMINE=174
210 IFB>YTHENY=Y+1:POKEX+Y-1,MINE:POKESOUND,220
220 IFA>XTHENX=X+22:POKEX-22+Y,160:POKESOUND,225
230 IFA<XTHENX=X-22:POKEX+22+Y,160:POKESOUND,230
240 IFB<YTHENY=Y-1:POKEX+Y+1,160:POKESOUND,235
250 POKEX+Y,62
255 CL=0:POKESOUND,0
260 MINE=160
265 IFX=AANDY=BTHEN800
280 RETURN
500 KM=INT(2*RND(1))
505 IFKM=0THENMINE=174
510 IFB>ZTHENZ=Z+1:POKEV+Z-1,160
520 IFA>VTHENV=V+22:POKEV-22+Z,160
530 IFA<VTHENV=V-22:POKEV+22+Z,160
540 IFB<ZTHENZ=Z-1:POKEV+Z+1,MINE
550 POKEV+Z,62
555 LC=0
560 MINE=160
565 IFV=AANDZ=BTHEN800
580 RETURN
800 POKEV+Z,209:POKEX+Y,209
801 POKEA+B,209
802 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■GAME  OVER"
803 PRINT"■■■■■■■■■■■PUSH'F7'"
804 GETA$:IFA$="■"THENRUN
805 FOKEA+B,215
806 FORT=1TO10:NEXTT
807 GOTO801
```

One problem with redefining a limited character set is that if the program crashes you will not be able to read the error message to find out at which line an error has occurred.

The solution here is to key in

POKE 36869,240

and then press return. This will send the Vic back to the standard character set in ROM and turn the garbage on the screen into letters. Be careful to key it in correctly since the letters you type will not appear as such on the screen.

In line 16 the border and screen colours are set by Poking the value 8 into 36879. Changing this value will set up other colour combinations. ■

SPECTRUM CROSS

Stuart Nicholls' crocodiles and man-eating spiders soon put a stop to uneventful commuting.

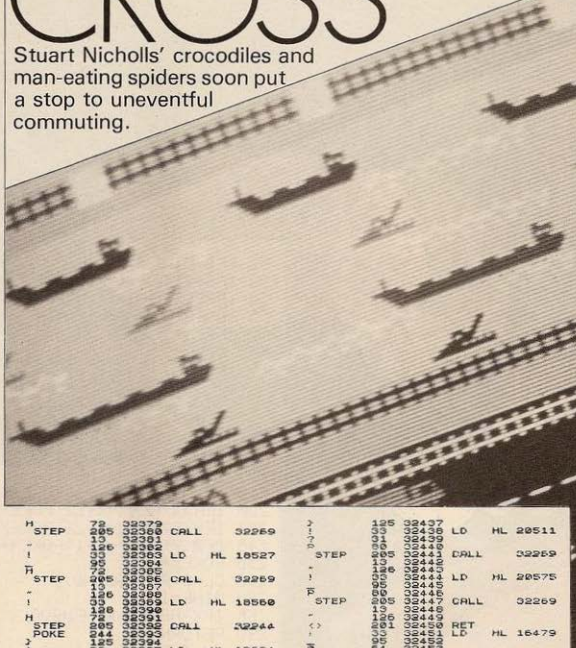
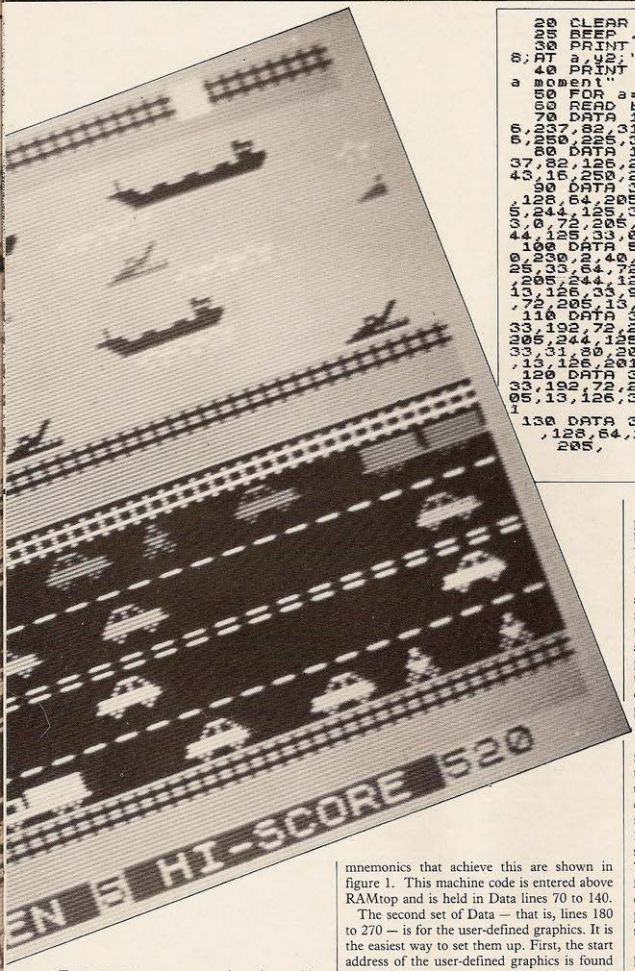


Figure 1.

```
        Code   Address    Mnemonic
        14     32244  LD     C  6
        6      32245
 RESTORE
        229    32246  PUSH  HL
?       17     32247  LD    DE 31
        31     32248
        0      32249
-       25     32250  ADD   HL DE
        126    32251  LD    A  hl
GO SUB  237    32252  ed
A       82     32253
?       31     32254  RRA
        6      32255  LD    B  32
-       32     32256
        126    32257  LD    A  hl
?       31     32258  RRA
w       119    32259  LD    hl A
#       35     32260  INC   HL
        16     32261  DJNZ  -6
 IF
LLIST   225    32262  POP   HL
*       36     32263  INC   H
        13     32264  DEC   C
        32     32265  JR    NZ -22
 REM
<>      201    32266  RET
        14     32267  LD    C  6
        32     32268
CODE    175    32269  XOR   A
RESTORE 229    32270  PUSH  HL
?       17     32271  LD    DE 31
        31     32272
        0      32273
GO SUB  237    32274  ed
A       82     32275
-       126    32276  LD    A  hl
        25     32277  ADD   HL DE
        23     32278  RLA
        6      32279  LD    B  32
        32     32280
-       126    32281  LD    A  hl
        23     32282  RLA
w       119    32283  LD    hl A
+       43     32284  DEC   HL
        16     32285  DJNZ  -6
 IF
LLIST   225    32286  POP   HL
*       36     32287  INC   H
        13     32288  DEC   C
        32     32289  JR    NZ -23
 DIM
<>      233    32290
        201    32291  RET
!       33     32292  LD    HL 16479
        95     32293
@       64     32294
 STEP   205    32295  CALL    32269
        13     32296
-       126    32297
!       33     32298  LD    HL 16512
        128    32299
@       64     32300
 STEP   205    32301  CALL    32244
 POKE   244    32302
>       125    32303
!       33     32304  LD    HL 16512
        128    32305
@       64     32306
 STEP   205    32307  CALL    32244
 POKE   244    32308
>       125    32309
!       33     32310  LD    HL 16607
 OUT    223    32311
@       64     32312
 STEP   205    32313  CALL    32269
        13     32314
-       126    32315
!       33     32316  LD    HL 18432
        0      32317
H       72     32318
 STEP   205    32319  CALL    32244
 POKE   244    32320
>       125    32321
!       33     32322  LD    HL 18432
        0      32323
H       72     32324
 STEP   205    32325  CALL    32244
 POKE   244    32326
>       125    32327
!       33     32328  LD    HL 18432
        0      32329
H       72     32330
 STEP   205    32331  CALL    32244
 POKE   244    32332
>       125    32333
!       33     32334  LD    A  (23673
 USR    121    32335
)       82     32336
(       0      32337  NOP
        0      32338  NOP
        0      32339  NOP
        0      32340  NOP
        0      32341  NOP
        0      32342  NOP
        0      32343  NOP
        0      32344  NOP
NEW     200    32345  AND  Z
        8      32346
(       40     32347  JR   Z  20
        20     32348
!       33     32349  LD   HL 18496
        64     32350
H       72     32351
 STEP   205    32352  CALL    32244
 POKE   244    32353
>       125    32354
!       33     32355  LD   HL 18496
@       64     32356
 STEP   205    32357  CALL    32244
 POKE   244    32358
>       125    32359
!       33     32360  LD   HL 18496
@       64     32361
H       72     32362
 STEP   205    32363  CALL    32244
 POKE   244    32364
>       125    32365
!       33     32366  JR    18
        24     32367
(       40     32368  JR   Z  18
        20     32369
!       33     32370  LD   HL 18527
        95     32371
H       72     32372
 STEP   205    32373  CALL    32269
        13     32374
-       126    32375
!       33     32376  LD   HL 18527
        95     32377
```

```
H       72     32378
 STEP   205    32379  CALL    32269
        13     32380
-       126    32381
!       33     32382  LD   HL 18527
        95     32383
H       72     32384
 STEP   205    32385  CALL    32269
        13     32386
-       126    32387
!       33     32388  LD   HL 18560
        128    32389
H       72     32390
 STEP   205    32391  CALL    32244
 POKE   244    32392
>       125    32393
!       33     32394  LD   HL 18624
 USR    192    32395
H       72     32396
 STEP   205    32397  CALL    32244
 POKE   244    32398
>       125    32399
!       33     32400  LD   HL 18624
 USR    192    32401
H       72     32402
 STEP   205    32403  CALL    32244
 POKE   244    32404
>       125    32405
!       33     32406  LD   HL 20511
        31     32407
?       31     32408
P       80     32409
 STEP   205    32410  CALL    32269
        13     32411
-       126    32412
!       33     32413  LD   HL 20511
        31     32414
?       31     32415
P       80     32416
 STEP   205    32417  CALL    32269
        13     32418
-       126    32419
!       33     32420  LD   HL 20575
        80     32421
P       80     32422
 STEP   205    32423  CALL    32269
        13     32424
-       126    32425
!       33     32426  LD   HL 18560
        128    32427
H       72     32428
 STEP   205    32429  CALL    32244
 POKE   244    32430
>       125    32431
!       33     32432  LD   HL 18624
 USR    192    32433
H       72     32434
 STEP   205    32435  CALL    32244
 POKE   244    32436
```

```
>       125    32437
!       33     32438  LD   HL 20511
?       31     32439
P       80     32440
 STEP   205    32441  CALL    32269
        13     32442
-       126    32443
!       33     32444  LD   HL 20575
        95     32445
P       80     32446
 STEP   205    32447  CALL    32269
        13     32448
-       126    32449
!       33     32450  RET
<>      201    32451
!       33     32452  LD   HL 16479
@       64     32453
H       72     32454
 STEP   205    32455  CALL    32269
        13     32456
-       126    32457
!       33     32458  LD   HL 16512
        128    32459
@       64     32460
 STEP   205    32461  CALL    32244
 POKE   244    32462
>       125    32463
!       33     32464  LD   HL 18432
@       64     32465
H       72     32466
 STEP   205    32467  CALL    32244
 POKE   244    32468
>       125    32469
<>      201    32470  RET
!       33     32471  LD   HL 16479
@       64     32472
H       72     32473
 STEP   205    32474  CALL    32269
        13     32475
-       126    32476
!       33     32477  LD   HL 16607
 OUT    223    32478
@       64     32479
 STEP   205    32480  CALL    32269
        13     32481
-       126    32482
!       33     32483  LD   HL 18560
        128    32484
H       72     32485
 STEP   205    32486  CALL    32244
 POKE   244    32487
>       125    32488
!       33     32489  LD   HL 18624
 USR    192    32490
H       72     32491
 STEP   205    32492  CALL    32244
 POKE   244    32493
>       125    32494
<>      201    32495  RET
```




```
  20 CLEAR 32243: GO TO 40
  25 BEEP .01,b-a
  30 PRINT OVER 1; PAPER 8; INK
8;AT a,y2;"*": RETURN
  40 PRINT AT 11,5;"Please wait
a moment"
  50 FOR a=32244 TO 32494
  60 READ b: POKE a,b: NEXT a
  70 DATA 14,8,229,17,31,0,25,12
6,237,82,31,6,32,126,31,119,35,1
6,250,225,36,13,32,234,201
  80 DATA 14,8,175,229,17,31,0,2
37,82,126,23,1,6,32,126,23,119,
43,16,250,225,36,13,32,233,201
  90 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,128,64,20
5,244,125,33,223,64,205,13,126,3
3,0,72,205,244,125,33,0,72,205,2
44,125,33,0,72,205,244,125
 100 DATA 58,121,92,0,0,0,0,0,
0,230,2,40,20,33,64,72,205,244,1
25,33,64,72,205,244,125,33,64,72
,205,244,125,24,18,33,95,72,205,
13,126,33,95,72,205,13,126,33,95
,72,205,13,126
 110 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,192,72,
205,244,125,33,31,80,205,13,126,
33,31,80,205,13,126,33,95,80,205
,13,126,201
 120 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,31,80,2
05,13,126,33,95,80,205,13,126,20
1
 130 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,0,72,
205,
```

(continued on next page)

THIS GAMES program — written in machine code and Basic — just fills a 16K Spectrum. It makes full use of all the colours available and all 21 user-definable graphics.

The object of the game is to cross a busy road and river to arrive safely home. The graphics are flicker-free and move smoothly. The graphics character for the man, however, flashes to indicate position.

The machine-code section of the program is used to roll a screen line left or right — one pixel at a time — to give the illusion of a smooth flow of traffic. The machine code and mnemonics that achieve this are shown in figure 1. This machine code is entered above RAMtop and is held in Data lines 70 to 140.

The second set of Data — that is, lines 180 to 270 — is for the user-defined graphics. It is the easiest way to set them up. First, the start address of the user-defined graphics is found by Peeking the system variable 23675/6, so it is equally suitable for the 16K and 48K Spectrum, and then all 168 bytes are entered, starting from this address, in one For-Next loop. It does seem rather long-winded to have 21 For-Next loops as suggested in the Spectrum manual, when the addresses of the user-defined graphics run consecutively.

Once the program has been entered it is advisable to Save it before Running just in case a wrong machine-code Data entry has been made which may cause the program to crash.

Your man moves at a speed of eight pixels per second and so can outrun all the traffic, but be careful not to hit traffic from behind. Use 0 to move right, 9 to move left, and 1 to move up.

A fanfare is played each time a home is filled and 50 bonus points are given. Every time four homes are filled an extra fanfare is played, the homes empty, the speed increases — there are three changes of speed — an extra random position spider is added, and the game continues. The spiders incidentally move in both directions. A maximum of 10 spiders can be placed on the central island, but I have not managed that level myself yet.

Each time your man is hit he will flash for a few seconds to the sound of a rising beep and then fall back down the screen to the base line to the sound of a falling beep. The men-counter will be reduced by one. The subroutine for this flash and beep — lines 25 and 30 — has been placed at the start of the listing so that access time is reduced to a minimum. The Spectrum searches through the listing from the beginning each time a subroutine is called and so, if placed at the end of the program, it would take longer to locate and slow down the rate of flash and beep.

At the end of the game, when all men are lost, you are given the option to replay or end. If the N key is pressed then RAMtop will be reset to its normal value on both 16K and 48K Spectrums and the program including user-defined graphics will be erased from memory. This is achieved in just one instruction

RANDOMISE USR 0

One last useful feature of the Spectrum is used to detect a hit. This is shown in line 690 when Screen$ will return a string containing a space if there is no traffic in the next "Print man" position or an empty string if the next Print position is a user-defined graphic or part of a user-defined graphic.

(continued from previous page)

```
244,125,201
 140 DATA 33,95,64,205,13,126,33
,223,64,205,13,126,33,128,72,205
,244,125,33,192,72,205,244,125,2
01
 150 LET a=PEEK 23675+256*PEEK 2
3676
 160 FOR b=a TO a+167
 170 READ c: POKE b,c: NEXT b
 180 DATA 15,18,34,127,255,255,4
0,16,128,64,32,254,254,255,40,16
 190 DATA 127,127,127,127,127,25
5,21,8,254,254,254,254,255,255,8
4,128
 200 DATA 0,248,196,196,254,254,
40,16,24,24,36,126,60,90,165,66
 210 DATA 56,40,146,124,56,56,40
,108,1,2,4,127,127,255,20,8
 220 DATA 240,72,68,254,255,255,
20,8,0,31,35,35,127,127,20,8
 230 DATA 127,127,127,127,255,25
5,2,1,254,254,254,254,255,16
8,16
 240 DATA 16,41,193,0,38,0,0,0,0
,68,255,68,68,255,68,0
 250 DATA 0,34,85,143,151,163,16
0,0,0,68,170,241,233,197,5,0
 260 DATA 16,16,16,254,63,31,15,
7,0,0,0,0,30,255,255,255
 270 DATA 96,124,84,120,127,255,
254,252,0,0,3,2,15,63,255,0,6,12
,152,240,224,85,255,0
 280 PRINT AT 11,8;"Do you want
instructions?";AT 13,11;"(y)es";
AT 15,11;"(n)o"
 290 PAUSE 0: IF INKEY$="y" THEN
 GO TO 300
 295 GO TO 400
 300 CLS : PRINT AT 0,11;"OBJECT
"'''To guide a ☠ across a road a
nd ariver,avoiding 🚗 🚌 & 🚢
 🚢.'''''A 🐀 patrols the central
 island."
 310 PRINT '''There are 4 HOMES
to be filled. i.e. gaps in top f
ence ##### #####"
 320 PRINT ''Once all 4 HOMES ar
e filled the speed will increase
,an extra 🐀 will be added and t
he HOMES willempty."
 330 PRINT '''AT 18,9;"Press any
key.": PAUSE 0
 370 CLS : PRINT AT 7,11;"CONTRO
LS"
 375 PRINT ''' ↑
 ← →
 380 PRINT FLASH 1;AT 11,6;"1";
FLASH 0;" 2 3 4 5 6 7 8 ";FLASH
 1;"9": FLASH 0;" ";FLASH 1;"0"
 390 PRINT AT 18,5;"Press any ke
y to PLAY": PAUSE 0
 400 BRIGHT 1: PAPER 5: BORDER 5
: CLS
 410 LET hi=0
 420 PRINT PAPER 4;AT 10,0;"
 🐀"
 430 LET lives=9: LET score=0: L
ET home=0
 440 POKE 32425,201: POKE 32450,
201: POKE 32469,201
 450 PRINT AT 0,0; PAPER 4;"######
"; PAPER 7;" "; PAPER 4;"#########"
; PAPER 7;" "; PAPER 4;"#########"
; PAPER 7;" "; PAPER 4;"#########"
; PAPER 7;" "; PAPER 4;"######"
 455 IF home<>0 THEN GO TO 660
 460 PRINT PAPER 4; INK 5;"
🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢
 470 PRINT "
🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢"
 480 PRINT INK 7;"  ~~~~  ~~~~
~~~~  ~~~~  ~~~~  ~~~~  ~~~~  ~~~~"
 490 PRINT INK 2;"  🚤  🚤
  🚤  🚤  🚤  🚤  🚤  🚤  🚤  🚤"
 500 PRINT INK 7;"~~~  ~  ~~~
~~~  ~~~  ~~~  ~~~  ~~~  ~~~  ~~~"
 510 PRINT INK 1;"🚢
🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢 🚢"
 520 PRINT INK 7;"  ~~~  ~~~~~~
~~~~"
 530 PRINT "🚤  🚤  🚤
  🚤  🚤  🚤  🚤  🚤  🚤  🚤  🚤  🚤  🚤"
 540 PRINT PAPER 4;"##########################
##########################"
 550 PRINT PAPER 0; INK 7;AT 11,
0;"##########################
#####"
 560 PRINT PAPER 0; INK 3;"🚗 🚗 🚗
 🚗 🚗 🚗 🚗 🚗 🚗 🚗 🚗 🚗 🚗 🚗"
 570 PRINT PAPER 0; INK 7;"-----
-----------------------------"
 580 PRINT PAPER 0; INK 5;"🚗
  🚗  🚗  🚗  🚗  🚗  🚗  🚗"
 590 PRINT PAPER 0; INK 7;"=====
==========================="
 600 PRINT PAPER 0; INK 4;"🚗
  🚗  🚗  🚗  🚗  🚗  🚗  🚗"
 610 PRINT PAPER 0; INK 7;"-----
-----------------------------"
 620 PRINT PAPER 0; INK 6;"🚌
 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌 🚌"
 630 PRINT PAPER 4;"##########################
##########################"
 640 PRINT PAPER 1;"
"
 650 PRINT PAPER 1; INK 7;" SCOR
E ";AT 21,11;" MEN "; PAPER 5; I
NK 0;lives; PAPER 1; INK 7;" HI-
SCORE "
 660 LET x1=20: LET y1=16: LET x
2=x1: LET y2=y1
 670 PRINT PAPER 8; INK 8;AT x1,
y1;"
 680 RANDOMIZE USR 32295
 690 IF SCREEN$ (x2,y2)=" " THEN
 GO TO 880
 700 LET a=x2: FOR b=25 TO 35: G
O SUB 25: GO SUB 25: NEXT b
 730 FOR a=x2 TO 20 STEP 2: GO S
UB 25: GO SUB 25: NEXT a
 740 LET lives=lives-1: PRINT AT
 21,16;lives
 750 LET x2=20
 760 IF lives<>0 THEN GO TO 680
 770 IF hi>score THEN GO TO 790
 780 LET hi=score: PRINT AT 21,2
7;hi
 790 PRINT FLASH 1; PAPER 7;AT 1
2,0;"              GAME   OVER
"
 800 PRINT AT 14,0;"  Another ga
me ? (y)es  (n)o"
 840 IF INKEY$="n" THEN RANDOMIZ
E USR 0
 850 IF INKEY$<>"y" THEN GO TO 8
40
 860 PRINT PAPER 5;AT 21,7;"
": GO TO 415
 880 IF x2<>0 THEN GO TO 1050
 890 PRINT PAPER 8; INK 8;AT x1,
y1;" ": PRINT AT x2,y2;"☠"
 900 RESTORE 920
 910 FOR a=1 TO 8: READ b,c: BEE
P b,c: NEXT a
 920 DATA .1,11,.1,11,.8,16,.05,
11,.05,16,.05,11,.05,16,1,20
 930 LET home=home+1: LET score=
score+50: PRINT AT 21,7;score
 950 IF home/4<>INT (home/4) THE
N GO TO 660
 960 IF home=4 THEN POKE 32425,0
 970 IF home=8 THEN POKE 32450,0
 980 IF home=12 THEN POKE 32469,
0
 985 IF home>36 THEN GO TO 450
 990 LET a=RND*31
1000 LET a=a+1
1005 IF a>31 THEN LET a=0
1010 IF SCREEN$ (10,a)="" THEN G
O TO 1000
1020 IF SCREEN$ (10,a+1)="" THEN
 GO TO 1000
1030 PRINT PAPER 4;AT 10,a;"🐀"
1035 RESTORE 920: FOR a=1 TO 8:
READ b,c: BEEP b,c: NEXT a
1040 GO TO 450
1050 PRINT PAPER 8; INK 8;AT x2,
y2;"☠"
1060 LET x1=x2: LET y1=y2
1070 IF INKEY$<>"1" THEN GO TO 1
100
1080 BEEP .001,33
1090 LET x2=x2-2: LET score=scor
e+5: PRINT AT 21,7;score
1100 LET y2=y2+(INKEY$="0" AND y
2<>31)-(INKEY$="8" AND y2<>0)
1110 GO TO 670
```

AB	= 🚗	HI	= 🚗	OP	= 🐀
CDE	= 🚌	JKL	= 🚌	QRS	= 🚢
F	= ☠	M	= ☆		
G	= ☠	N	= #	TU	= 🚤 ■

HOW TO GROW UP TO A REAL COMPUTER

SEE US AT 5th ZX MICROFAIR DECEMBER 8th NEW HORTICULTURAL HALL, LONDON SW1

If you're enthusiastic about microcomputing, sooner or later you'll ask yourself the question . . . "where do I go from here?"

This is particularly true if you own a micro with limited expansion and hardware peripheral options . . . like the ZX81.

Now your question can be answered in three short words:

BASICARE MICRO SYSTEMS

BASICARE are the inventors, developers and manufacturers of a totally unique microcomputing upgrade system.

It's the sort of system others have dreamed about . . . a series of separate modules that perform a whole range of microcomputing functions that simply (and firmly) stack together.

How BASICARE build into a complete computing package.

If you're confused . . . don't be . . . you only have to think of it in terms of the way Hi-Fi equipment has evolved.

You buy the hardware you want and add to the system! Each module may have a separate function or integrate functions. And when you want more . . . you add more!

In short you can develop a whole range of hardware options that fit together to form a complete package . . . "Computing" in the real sense of the word!

And what a package!

Apart from it's good looks and stability under working conditions, BASICARE MICRO SYSTEMS offers a fantastic range of micro options for ZX81 users.

Of course, such a system needs a starting point from which to expand. The heart of BASICARE'S system is a unique computer interface which we call PERSONA.

This one unit simply plugs into your ZX81 without modification and acts as the "brains" of the whole operation.

Thereafter you choose how you want to expand your micro by simply plugging-in more modules.

Look at the choice you have:

PERSONA — An interface module to enable an ORGANIC MICRO to grow on the ZX81.
MINIMAP — A memory mapping device to extend the address space of the ZX81 from 64K bytes to 1 M bytes.
RAM 08 — A low cost, low power memory expandable from 2K to 8K.
RAM 16 — 16K Add on memory at remarkably low cost.
RAM 64 — A TRUE 64K Add on memory.
DROM — Ultra low power memory backed by rechargeable battery for non-volatile storage of programs and data.
TOOLKIT — A module fully socketed to take up to 8K bytes of utilities in EPROM/ROM.
PERICON a — A general purpose, user programmable device providing 24 lines of input/output.
PERICON b — 24 lines of heavy duty output to access and control the outside world.
PERICON c — A module to drive 80 column printer with Centronics type parallel interface.
USERFONT option — User definable characters available for RAM 08, DROM and TOOLKIT.

Of course, there's lots more BASICARE Modules under development including joysticks, EPROM Programmer, Floppy Disc Controller and much more.

BASICARE is the sort of system that GROWS when you grow . . . and remember, when you change your micro, you will be able to change to a PERSONA unit to suit your new equipment!

In short, BASICARE will serve you forever . . . no matter how big you want to grow!

"As space is limited to describe BASICARE products, we have produced a fully documented brochure . . . send for it today (enclosing stamp please).

BASICARE MICRO SYSTEMS are available by mail simply by sending today together with cheque/PO/Access or Barclaycard No. Please indicate clearly your exact requirements.

Name _____

Address _____

PERSONA	@ £30.25	DROM(2K)	@ £39.50
MINIMAP	@ £35.95	TOOLKIT	@ £22.20
RAM8 (2K)	@ £24.50	PERICON A	@ £27.90
RAM16	@ £26.75	PERICON B	@ £33.75
RAM64	@ £76.25	PERICON C	@ £41.75

Options: USERFONT @ £8.00, Add. 2K for RAM8 @ **£6.50,** Add. 2K for DROM @ **£7.50**

All prices include VAT, postage and packing in the U.K. (Overseas allow at least 15% for surface mail).
Post to day to: BASICARE MICROSYSTEMS LTD., Dept YZ
5 Dryden Court, London SE11 4NH or Phone: 01-735 6408

BASICARE MICRO SYSTEM

THE FLEXIBLE COMPUTER SYSTEM FOR THE FUTURE

ORIC-1

CREATED BY TANGERINE

How can Tangerine promise you a professional computer for only £99.95? Because, unlike most computer builders, we have designed the U.L.A. ourselves.

This makes the ORIC-1 substantially more reliable and versatile to work with and what's more, at £99.95, you get a professional system well below the price of all leading manufacturers.

We can give you prompt service, quality, reliability and full technical backup: The ORIC Computer System will guarantee you that and more:

- 8 colour graphic display (8 foreground + 8 background)
- 40 character by 28 line colour text display
- High resolution graphics (240/200 pixels) 240 across screen, 200 down
- 96 User defined graphics symbols
- Microsoft BASIC software
- 6 octaves of music with Hi-Fi output and 4 preset sound effects – Shoot, Explode, Ping, Zap
- Centronics printer interface (compatible with a whole range of standard printers)
- Optional Communications Modem (allowing access to 200,000 pages of Prestel and direct link with other computers)
- Typewriter style keyboard
- Professionally written user manual by well-known computer authors
- Oric Owner Magazine included with each ORIC 1 purchased
- Tan-Forth supplied free with every mail order 48K Model
- Extended Basic (BBC etc) available soon
- Full range of business and leisure software coming shortly.

ONLY £99.95 (inc. VAT) FOR 16K RAM VERSION

(Please allow 28 days for delivery) **Subject to availability**

Order your ORIC-1 direct from the designers

BY POST: You can pay by cheque, postal order, ACCESS – BARCLAYCARD-VISA

BY PHONE: Just ring our telesales number ELY (0353) 2271/2/3/4

Please delete/complete as applicable.
*I enclose a cheque/p.o. payable to TANGERINE COMPUTER SYSTEMS LTD. For £
Please charge my Access, Barclaycard, Visa No.

Name
Address

If you require a VAT receipt please tick ☐

Please send me a full colour brochure ☐

Item	Qty	Price Inc. VAT	Total
ORIC-1 16K RAM		£99.95	
ORIC-1 48K RAM		£169.95	
ORIC Communications Modem		£79.00	
ORIC Owner Magazine (Bi-monthly)		£10.00	
Postage and packing		£5.95	
		TOTAL £	

TANGERINE COMPUTER SYSTEMS LTD. 3 Club Mews, Ely Cambs CB7 4NW

Here is the rest of the program required to put a spring in the step of Stuart Nicholls' Happy Hopper. Good luck with your ZX games.

HOPPER

FROGGER (moving graphics)

16775	0E 00	LD C, 00	Roll left/right subroutine.
	7E	LD A, (HL)	A check is make at start of each
	FE 97	CP 97	line to see if the frog will roll off the
	28 1F	JRZ +31	screen. If it does, then a jump is made
	F5	PUSH AF	to miss out the roll sequence.
	06 13	LD B, 13	
	23	INC HL	The background character occupied by the
	7E	LD A, (HL)	frog is then found and used to erase
	2B	DEC HL	the frog. Also C is increased to 1 so
	77	LD(HL), A	that a check can be make that the
	23	INC HL	subroutine has been skipped.
	10 F9	DJNZ -7	
	F1	POP AF	
	77	LD(HL), A	
	19	ADD HL, DE	
	7E	LD A, (HL)	
	FE 97	CP 97	
	28 0D	JRZ +13	
	F5	PUSH AF	
	06 13	LD B, 13	
	2B	DEC HL	
	7E	LD A, (HL)	
	23	INC HL	
	77	LD(HL),A	
	2B	DEC HL	
	10 F9	DJNZ -7	
	F1	POP AF	
	18 04	JR +4	
	0C	INC C	Increase value of C to 1
	3A 3C 40	LD A, (16444)	Get occupied square character and
	77	LD(HL),A	print over frog.
	C9	RET	Return from subroutine.
			Start of moving graphics routine
16819	2A 0C 40	LD HL(D-FILE)	Get start of D-File.
	23	INC HL	
	11 15 00	LD DE 00 15	LD DE with 21 — DE is not altered from this
	19	ADD HL, DE	value during program, and move to row 2
	CD 87 41	CALL SUB 16775	Roll this row left and next row right.
	0D	DEC C	Check to see if C = 1
	28 BO	JRZ (To 16753)	if yes, goto 16753
	19	ADD HL, DE	Move down one line.
	CD 87 41	CALL SUB 16775	Roll row left and next row right.
	0D	DEC C	Check to see if C = 1,
	28 A9	JRZ (To 16753)	if yes, goto 16753.
16840	2A 0C 40	LD HL (D-File)	Move along display until frog is
	7E	LD A, (HL)	found. When found erase it with
	FE 97	CP 97	character stored at 16444. Then
	28 03	JRZ +3	store D-file position of frog at
	23	INC HL	16445/6. Remove the frog from
	18 F8	JR -8	the display before rolling the road
	3A 3C 40	LD A (16444)	otherwise the frog will move with the
	77	LD(HL),A	traffic.
16858	2A 0C 40	LD HL (D-File)	Get start of road 6 lines down.
	23	INC HL	
	06 06	LD B, 06	
	19	ADD HL, DE	
	10 FD	DJNZ -3	
	CD 87 41	CALL 16701	Call roll left/right
	19	ADD HL, DE	Move to next line
	CD 87 41	CALL 16701	Call roll left/right.
			There is no need for a check that C = 1
			as frog has been removed from display.
16874	2A 3D 40	LD HL,(16445/6)	Load HL with frog position.
	3A 26 40	LD A,(16422)	Load A with "last key high"
	FE DF	CP DF	Value if key is "5"
	20 03	JRNZ +3	
	2B	DEC HL	If 5 then decrease HL
	18 22	JR (16921)	
	FE F7	CP F7	Value if key is 8
	20 03	JRNZ +3	
	23	INC HL	If 8 then increase HL
	18 1B	JR (16921)	
	FE FD	CP FD	Value if key is 0
	20 17	JRNZ (16921)	
	ED 52	SBC HL, DE	If 0 then move 1 line.
	E5	PUSH HL	Store new position of frog.
16901	2A 0C 40	LD HL(D-File)	Increase score routine. Used only
	01 ED 00	LD BC 00 ED	when frog moves up.
	09	ADD HL, BC	
	7E	LD A,(HL)	
	3C	INC A	
	FE A6	CP A6	
	20 05	JRNZ +5	
	36 9C	LD(HL), 9C	
	2B	DEC HL	
	18 F5	JR -11	
	77	LD(HL), A	
16920	E1	POP HL	Get store new frog position
	7E	LD A(HL)	Check that it is not off screen.
	FE 76	CP 76	
	20 04	JRNZ +4	If not, then check new position
	2A 3D 40	LD HL(156446/6)	If it is off screen then get original
	7E	LD A,(HL)	position and check it.
	FE 17	CP 17	Check if home
	20 10	JRNZ +16	
	36 AD	LD(HL), AD	If home then print H.
16936	2A 0C 40	LD HL(D-File)	Check top row to see if all home
	23	INC HL	bases are filled, if yes then return
	7E	LD A(HL)	to Basic. If * is found, then
	FE 76	CP 76	jump to dual-purpose delay at 16966.
	C8	RETZ	
	FE 17	CP 17	
	20 F7	JRNZ -7	
	18 10	JR +16	
16950	FE 80	CP 80	Check new frog position for safe
	28 IC	JRZ (16982)	squares that is road logs lily or
	FE 83	CP 83	kerbs, and if any of these then
	28 18	JRZ (16982)	proceed to 16982.
	FE 1C	CP 1C	
	28 14	JRZ (16982)	
	FE 08	CP 08	
	28 10	JRZ (16982)	
			Dead frog/home delay
16966	F5	PUSH AF	
	36 17	LD(HL), 17	Print an * in place frog/ found unfilled home position
	11 00 10	LD DE, 10 00	Delay loop
	1B	DEC DE	
	7A	LD A, D	
	BC	OR E	
	Z + * FB	JRNZ -5	
	F1	POP AF	Get original square character.
	77	LD(HL) A	Print it.
	C3 71 41	JP (16753)	Start again with frog at baseline
16982	32 3C 40	LD(16444),A	Store new square value before
	36 97	LD(HL) 97	overprinting frog.
16987	2A 0C 40	LD HL (D-File)	Decrease time routine as in
	01 F7 00	LD BC, 00 F7	demonstration program except that
	09	ADD HL, BC	numbers are in inverse video.
	7E	LD A(HL)	
	A7	ADD A	
	20 08	JRNZ +8	
	06 03	LD B, 03	
	23	INC HL	
	36 9C	LD(HL) 9C	
	10 FB	DJNZ -5	
	C9	RET	
	3D	DEC A	
	FE 9B	CP 9B	
	20 05	JRNZ +5	
	36 A5	LD(HL),A5	
	2B	DEC HL	
	18 EA	JR −22	
	77	LD(HL), A	
17017	11 00 30	LD DE, 30 00	Delay loop — governs speed of game.
	1B	DEC DE	to increase speed, reduce value of DE
	7A	LD A,D	
	B3	OR E	
	20 FB	JRNZ −5	
17025	C3 B3 41	JP 16819	GOTO 16819 — start of routine.

```
10 REM A-MAZ-ING COPYRIGHT K & S
BRAIN NOV 1982
20 GOTO10000
100 CLS:PRINT@224,"TIME",,"MOVES
",,"FOOD",,"MONEY"
110 X=U-99:Y=U+99:Z=Y-X:FORA=0TO
 Z STEP32:FORC=0TO6:PRINT@ (A+C)
,CHR$(B(X+A+C)):NEXTC,A:PRINT@26
2,M
120 T=(INT(TIMER/50)):IFT>UP THE
N12000ELSEPRINT@230,T:PRINT@294,
F:PRINT@326,MO
130 A=JOYSTK(0):AA=JOYSTK(1):IFA
>10ANDA<50ANDAA>10ANDAA<50THEN12
0
140 M=M+1:F=F-1:IFF<1THEN13000
150 IFA<10THENV=U-32
160 IFA>50THENV=U+32
170 IFAA>50THENV=U-1
180 IFAA<10THENV=U+1
190 IFB(V)<>143THEN210
200 B(U)=143:U=V:B(U)=YU:PRINT@3
84,"":GOTO110
210 IFU=0 THEN11000
220 IFB(V)=128THENPRINT@84,"NO W
AY":SOUND1,5:GOTO110
230 IFB(V)=144THEN14000
240 IFB(V)=100THENPRINT@384,"CON
GRATULATIONS",,"YOU HAVE FOUND T
HE DRAGON":YU=117:GOTO200
250 IFB(V)<145THEN110
260 ON(B(V)-143)/16GOTO1000,2000
,3000,4000,5000,6000,7000
1000 F=F+50:PRINT@84,"FOOD";SOUN
D150,5:GOTO200
2000 MO=MO+50:PRINT@84,"MONEY":S
OUND200,5:GOTO200
3000 DATA3,0,4,0,5,0,6,0,7,0,3,1
,5,1,7,1,3,2,4,2,5,2,6,2,7,2,0,3
,1,3,2,3,3,3,7,3,8,3,9,3,10,3,3,
4,4,4,5,4,6,4,7,4
3010 DATA3,5,4,5,5,5,6,5,7,5,3,6
,4,6,5,6,6,6,7,6,3,7,4,7,5,7,6,7
,7,7,3,8,4,8,6,8,7,8,3,9,4,9,6,9
,7,9,1,10,2,10,3,10,4,10,6,10,7,
10,8,10,9,10,1,11,2,11,3,11,4,11
,6,11,7,11,8,11,9,11
3020 C=RND(8):CLS0:FORN=1TO65:RE
ADX,Y:SET(X,Y,C):NEXT:RESTORE
3030 FORN=1TO20:SET(0,2,C):SET(1
0,2,C):FORZ=1TO50:NEXTZ:RESET(0,
2):RESET(10,2):FORZ=1TO50:NEXTZ:
SET(0,4,C):SET(10,4,C):FORZ=1TO5
0:RESET(0,4):RESET(10,4):FORZ=1T
050:NEXTZ
3040 PRINT@224,"YOU HAVE MET A T
ROLL","WITH A PASSION FOR MONEY!
"
3050 PRINT@320,"UNLESS YOU GIVE
HIM $100","HE WILL EAT YOU!!":NE
XT
3060 PRINT@224,,,,,,,,,,,:PRINT@
224,"YOU HAVE $";MO
3070 IFMO>99THEN3100
3080 SET(0,2,C):SET(10,2,C)
3090 FORN=1TO50:FORM=4TO6:SET(M,
3,C):FORZ=1TO50:NEXTZ:RESET(M,3)
:NEXTM:PRINT@384,"THE TROLL JUST
 ATE YOU":SOUND1,1:NEXTN:RUN
3100 SET(0,4,C):SET(10,4,C)
3110 MO=MO-100:PRINT@352,"YOU HA
D ENOUGH TO PAY THE TROLL":PRINT
@384,"YOU NOW HAVE $";MO;"LEFT"
3120 FORN=1TO20:RESET(6,8):RESET
(6,9):RESET(6,10):RESET(6,11):RE
SET(7,11):RESET(8,11):RESET(8,12
):SET(8,8,C):SET(8,9,C):SET(9,8,
C):SET(9,9,C)
3130 FORZ=1TO50:NEXTZ:SET(6,8,C)
:SET(6,9,C):SET(6,10,C):SET(6,11
,C):SET(7,11,C):SET(8,11,C):SET(
8,12,C):RESET(8,8):RESET(8,9):RE
SET(9,8):RESET(9,9):NEXTN:GOTO10
0
4000 PCLS:PMODE3,1:SCREEN1,0
4010 FORN=1TO16:DRAW"C4":DRAW"S"
+STR$(N):DRAW"A0L18H4U4E4R36F4D4
G4L18C2BM-4,-5LHUERFDGLBM+8,+0LH
UERFDGLBM-3,+5"
```

MAZE GAMES — a well-established part of home computer tradition — offer endless scope for imagination in programming, as well as hours of frustration in the playing. You are always sure that if you try just once more you will succeed. The scenarios of maze-type adventure games are many and varied but the principles are usually very similar. They may be text-only or they may give you a graphic indication of your whereabouts and the consequences of your actions. Your view is generally limited to your immediate surroundings, and the perils you may have to face are many and varied.

The principles of maze construction and the main running routine given here are of general application, whilst the consequence routines give examples of the sort of effects you can produce with a little effort.

The total program given requires that you escape from the maze with as much money as possible, and preferably rescue the dragon from St Clair at the same time, before you run out of time or food, and before you are eaten by a troll or a giant spider.

If you only enter lines 20-260 and from 10000-10110 you can dream up your own consequence subroutines and amaze yourself with your own ingenuity.

A simple method of setting up a maze on the Dragon is to use a variable array. The text screen contains 512 print positions, so this is a convenient number to deal with. Life is actually simpler if the array is rather bigger than this, and adding an extra three lines at the top and bottom gives a total of 672 for the array. Of course, various items also need to be included in appropriate numbers. The array and its contents are dealt with in the routine at 10000.

Line 10020 sets up the variables: A1 is the array size; A2 is the screen start; A3 is the screen end; A4 is the screen size; A5 is the number of blocked paths; A6 is the number of items; A7 is the number of space warps; MO is the money; UP is the time allowed; F is food; YU is you.

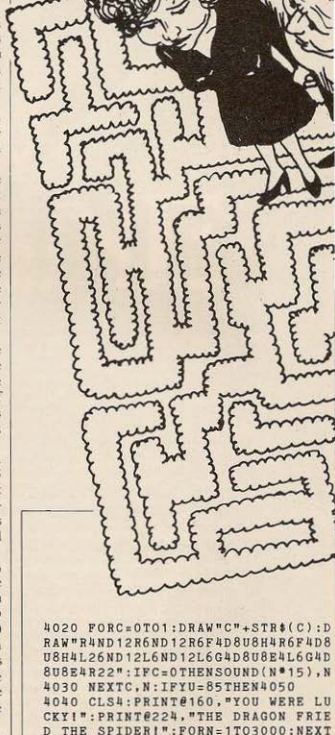
Line 10030 sets up the array and fills it with CHR$(128) — black. Line 10040 inserts A5 (450) green — CHR$(143) — pathways at random. Line 10050 inserts A6 (50) randomly-coloured blocks at random. Line 10060 inserts A7 (50) space warps — CHR$(144) — but still black, at random.

Line 10070 resets the bottom but one line to green, to give you a chance to escape. Line 10080 sets the way out — O — on the bottom line, and sets you — U — and the dragon — D — in random start positions. Line 10090 checks that you can move in your first turn and if not, redraws the maze. Line 10100 prints the maze on the screen. Line 10110 clears the low- and high-resolution screens and sets the internal timer to zero then leads back to the main running routine at 100.

This routine is at the beginning of the program so that it is executed as rapidly as possible. The speed of Dragon Basic is such that this update routine works almost as fast as you can think what to do next.

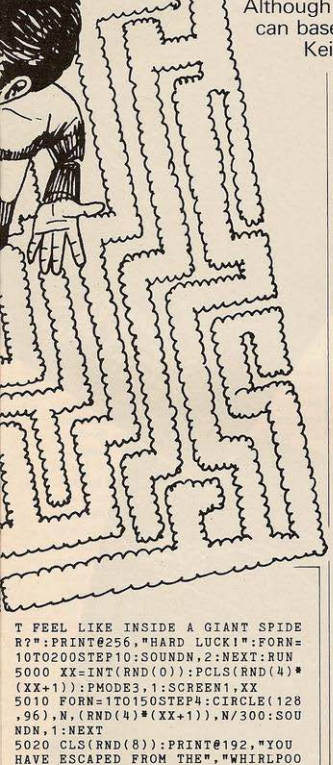
Line 110 looks at the three lines above and below your present position, prints out the contents of the array for a small distance — C — either side and above and below your

MAZE



```
4020 FORC=0TO1:DRAW"C"+STR$(C):D
RAW"R4ND12R6ND12R6F4D8U8H4R6F4D8
U8H4L26ND12L6ND12L6G4D8U8E4L6G4D
8U8E4R22":IFC=0THENSOUND(N*15),N
4030 NEXTC,N:IFYU=85THEN4050
4040 CLS4:PRINT@160,"YOU WERE LU
CKY!":PRINT@224,"THE DRAGON FRIE
D THE SPIDER!":FORN=1TO3000:NEXT
:GOTO200
4050 LU=RND(10):IFLU<5THEN4070
4060 CLS2:PRINT@128,"YOU WERE LU
CKY!":PRINT@192,"THE SPIDER COUL
DN'T STAND THE   TASTE OF YOU!":
FORN=10TO250STEP2:SOUNDN,1:NEXT:
GOTO100
4070 CLS0:PRINT@128,"WHAT DOES I
```

MACHINE : DRAGON



Although it's a full game in itself, you can base new subterranean epics on Keith and Steven Brain's maze.

```
T FEEL LIKE INSIDE A GIANT SPIDE
R?":PRINT@256,"HARD LUCK!":FORN=
1TO200STEP10:SOUNDN,2:NEXT:RUN
5000 XX=INT(RND(0)):PCLS(RND(4)*
(XX+1)):PMODE3,1:SCREEN1,XX
5010 FORN=1TO150STEP4:CIRCLE(128
,96),N,(RND(4)*(XX+1)),N/300:SOU
NDN,1:NEXT
5020 CLS(RND(8)):PRINT@192,"YOU
HAVE ESCAPED FROM THE","WHIRLPOO
L BUT YOU LOST:",
5030 LM=RND(0):LF=RND(0):PRINT,I
NT(MO*LM);"MONEY",,INT(F*LF);"FO
OD":FORN=1TO5000:NEXT
5040 MO=MO-INT(MO*LM):F=F-INT(F*
LF):GOTO100
6000 CLS4:FORN=1TO32:PRINTCHR$(1
85);:NEXT:PRINT@32,"I'M ST CLAIR
 AND I'LL KILL","ANYONE WHO HELP
S THAT DRAGON!!";:FORN=1TO32:PRI
```

position and prints the move number — M. Line 120 checks if time is up and, if not, prints the time, T; food, F; and money, MO.

Line 130 checks that the joystick is not centred. Line 140 updates the move and food counters and checks for starvation. Lines 150-180 calculate your next position. Line 190 checks if the pathway chosen is clear and, if so, line 200 updates your position. Line 210 checks for the exit, 220 for a blocked pathway, and 230 for a space warp.

Space warps are difficult to avoid, as CHR$ (144) looks exactly the same as CHR$(128). They can be avoided by not bumping against the walls, but sometimes you need to be able to find one to get out of a dead end. Line 240 reports the dragon and converts you into an inverse U. Line 260 directs the program to the various routines dealing with coloured blocks.

The alternative lines 130, 150-180 use the cursor keys in place of a joystick, but we think this makes it too easy as you do not have to remember to centre the joystick to avoid re-entering a disastrous routine.

The routines at 1000 and 2000 simply increase your food and money, and delete these items from the array.

The Troll routine at 3000 uses a mixture of text and low-resolution graphics, and checks for money. Note that data must be restored after use, and that you only need to erase and reconstruct parts which move.

The Spider routine at 4000 uses high-resolution graphics and a scaled draw command. Dragons fry spiders, otherwise you have a 50:50 chance of escaping. Note that only the legs are erased — drawn in background colour — and redrawn for each move, and that the dragon is detected by YU being inverse.

The whirlpool routine at 5000 uses the circle command and both screens — XX=INT (RAND(0) — and loses you a random proportion of your food and money.

The St Clair routine at 6000 checks for the dragon, which he does not like.

The seeing stone at 7000 quickly prints out the whole maze, and the final successful status report is at 11000.

Failure due to time is reported by 12000, and due to starvation at 13000. Finally the space warp routine at 14000 displays a space warp of random length, of random colours, and at a random angle. It can move you anywhere in the maze. ■

```
NTCHR$(185);:NEXT:IFYU=117THEN60
20
6010 PRINT@320,"YOU MUST TELL ME
 IF YOU SEE HIM":FORN=1TO5000:NE
XT:GOTO100
6020 PRINT@288,"DEATH TO ALL YOU
 DRAGON LOVERS!",,"ST CLAIR?":FO
RM=1TO3:FORN=100TO1STEP-5:SOUNDN
,M:NEXTN,M:RUN
7000 CLS2:PRINT@224,"THE SEEING
STONE WILL GIVE YOU","A BRIEF GL
IMPSE OF THE MAZE":FORN=1TO1000:
NEXT
7010 CLS0:FORN=97TO576:PRINTCHR$
(B(N));:NEXT:FORN=1TO250:NEXT:CL
S:GOTO100
10000 CLS:PRINT"    MAZE UNDER C
ONSTRUCTION",,," ";CHR$(85);"= Y
OU",CHR$(100);"= DRAGON",,," ";C
HR$(117);"= YOU + DRAGON",,,,," 
";CHR$(159);"= FOOD",CHR$(175);"
= MONEY",,,
10010 PRINT" ";CHR$(191);"= TROL
L",CHR$(207);"= SPIDER",,," ";CH
R$(223);"= WHIRLPOOL",CHR$(239);
"= ST CLAIR",," ";CHR$(255);"= S
EEING STONE"
10020 A1=672:A2=97:A3=576:A4=447
:A5=450:A6=50:A7=50:MO=100:UP=10
00:F=800:YU=85
10030 DIMB(A1):FORA=1TOA1:B(A)=1
28:NEXT:SOUND1,1
10040 FORA=1TOA5:B(RND(0)*A4+A2)
=143:NEXT:SOUND10,1
10050 FORA=1TOA6:B(RND(0)*A4+A2)
=(RND(7)*16)+143:NEXT:SOUND20,1
10060 FORA=1TOA7:B(RND(0)*A4+A2)
=144:NEXT:SOUND30,1
10070 FORA=513TO544:B(A)=143:NEX
T:SOUND40,1
10080 O=545+RND(29):B(O)=143:U=R
ND(A4)+A2:B(U)=YU:D=RND(A4)+A2:B
(D)=100:SOUND50,1
10090 IFB(U+1)=143ORB(U-1)=143OR
B(U+32)=143ORB(U-32)=143THEN1010
0ELSESOUND1,10:RUN
10100 CLS0:FORA=A2 TO A3:PRINTCH
R$(B(A));:NEXT
10110 FORA=1TO1000:NEXT:CLS:PCLS
:TIMER=0:GOTO100
11000 CLS(RND(8)):PRINT@96,"CONG
RATULATIONS - YOU ESCAPED!",,,"Y
OU TOOK"M"MOVES",,,"YOU HAD:",MO
;"DOLLARS",,F;"FOOD",,(UP-T);"TI
ME LEFT"
11010 IFYU=117THENPRINT@384,"AND
 YOU HAD THE DRAGON WITH YOU!"
11020 FORN=1TO8000:NEXT:RUN
12000 CLS0:PRINT@224,"YOU RAN OU
T OF TIME!",,,"THIS IS THE END O
F YOUR UNIVERSE":FORN=1TO1000:NE
XT:CLS0:FORN=250TO1STEP-1:SOUNDN
,1:NEXT:RUN
13000 CLS0:PRINT@224,"YOU STARVE
D TO DEATH!",,,"BETTER LUCK IN Y
OUR","NEXT REINCARNATION!!":SOUN
D1,50:RUN
14000 PCLS(RND(4)):PMODE3,1:SCRE
EN1,0:FORNM=1TO(RND(4)):FORN=1TO
62STEPNM:DRAW"S"+STR$(N):DRAW"C"
+STR$(RND(3)):DRAW"BM-6,+8U16R12
D16L12BM128,96":SOUND(NM*N),1:NE
XTN:DRAW"A"+STR$(RND(2)):NEXTNM
14010 B(U)=143:U=RND(431)+128:B(
U)=YU:V=U
14020 CLS0:FORN=97TO576:PRINTCHR
$(B(N));:NEXTN:FORN=1TO500:NEXTN
:CLS:GOTO100
```

alternative lines for use of cursor keys instead of a joystick for movement

```
130 I$=INKEY$:IFI$=""THEN130ELSE
I=ASC(I$)
150 IFI=94THENV=U-32
160 IFI=10THENV=U+32
170 IFI=8THENV=U-1
180 IFI=9THENV=U+1
```

TURNING

Turtle graphics are the family of drawing routines at the heart of Logo. Fintan Culwin presents a full turtle program for the BBC Micro.

LOGO IS A computer language and a powerful educational tool. It has many of the characteristics of the almost synonymous Lego, insofar as Logo provides a small number of basic building blocks. The blocks can be put together very easily to produce complicated results.

Logo has no formal syllabus or correct methods. The emphasis is not on learning the facts about Logo, but learning about thought processes that can be extended to other situations. Seymour Papert in *Mindstorms* gives an example of extending Logo ideas to juggling; a skill that I was able to learn in 30 minutes after reading his analysis.

Allowing a child to explore a Logo system by exploring his or her own ideas and being rewarded by feelings of creative and aesthetic achievement uses the most powerful motivating forces. Most educational software is much more conservative, relying on practice rather than creativity and producing external rewards.

As a computer language a full version of Logo should provide the minimal features of a high-level language: loop structures, decision-branching and editing facilities; in addition, a full Logo includes powerful features such as list-processing and recursive functions.

Logo, like Lisp and Forth, is a threaded interpretative language. It provides a small number of system commands which, when referenced, call short machine-code subroutines. The systems commands can be linked together to give a user-defined command which can then be included within a further defined command.

One of the advantages of using Logo as an introductory computer language is that the structuring of programs in Basic follows naturally from this experience. The problems of spaghetti programming are avoided.

Full implementations of the Logo language are rare and expensive. The TI-99/4 version costs £60 and the BBC version is reported to cost £55. It is much more usual to find a subset of Logo commands and facilities related only to controlling a screen object called a turtle. This limited system is known as graphics Logo or turtle talk.

In this program the routines to control the screen are controlled by Basic subroutines. The program also does not allow procedures to be defined with a parameter but does support very powerful use of the Logo variables which can produce the same effect. Designed for use by children, the system is very user-friendly and almost crash-proof. It has been well-tested with groups of children and does provide an effective Logo environment. If your seven-year-old cannot handle Basic, try this instead. You may not need a secondary school if you do.

Commands are given to the system either by using one of the system command mnemonics in table 1 or by giving one of the defined commands. If a system command is given, it may or may not require a parameter. Numeric parameters can be given either as a number or as a term that includes the system variables NM, TR, SZ.

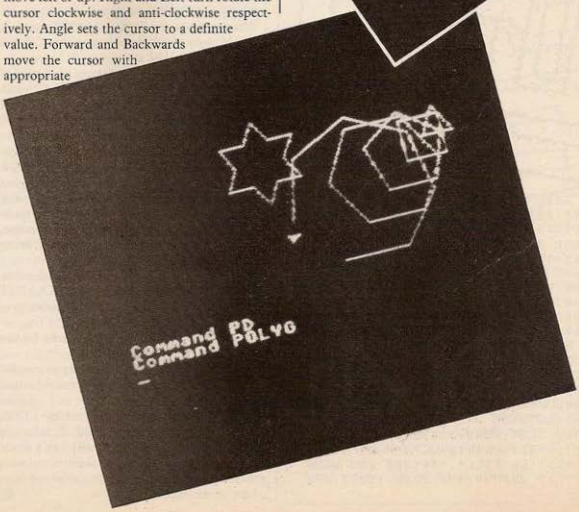
Numeric parameters can be evaluated by the Basic Eval function. If the Eval function is used with a parameter string that cannot be evaluated, an error condition is produced that crashes the system down to its lowest level.

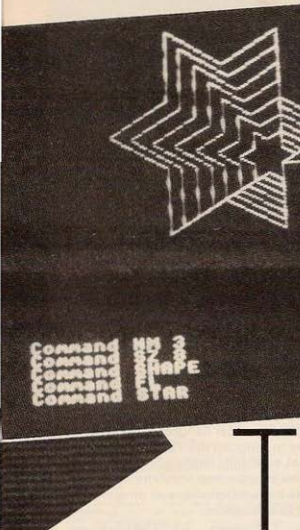
A string parameter is the name of a command; for memory efficiency it should not be longer than eight characters. System commands have to be given to the system as mnemonic space parameters.

Clear Screen clears the screen, resets the angle to 0 and homes the cursor to the centre of the screen. Pen Up and Pen Down set trace output from the cursor off and on. Fill and End Fill fills the areas in the same way as Plot in BBC Basic, starting with the second point after Fill is called. Cursor On and Off switch the cursor on and off. Long procedures can be speeded up significantly by turning the cursor off.

Quit allows you to leave the system to store definitions on tape. The definitions are stored as strings — this is exactly the situation where the most cassette-filing system errors occur so make sure you have your CFS patch in when you use it.

Cursor Right and Down move the cursor around the screen. Use negative parameters to move left or up. Right and Left turn rotate the cursor clockwise and anti-clockwise respectively. Angle sets the cursor to a definite value. Forward and Backwards move the cursor with appropriate






```
L.
   4 REM VER 4YC
   5 ON ERROR GOTO 2500
  20 PROCINT
  30 MODE 7
  40 CLS:FORNX=0 TO 1:PRINTTAB(15,NX)CHR$480;CHR$481;"MYLOGS":PRINTTAB(17,N
X+2)"*****":NEXT
  50 PRINTTAB(3,7);"DO YOU WANT TO INPUT DEFINITIONS FROM   A TAPE (Y/N) ?
"
  60 R=GET:IF (R<>78 AND R<>89) THEN 60 ELSE IF R=78 THEN 150
  65 PRINT"PUT DATA TAPE IN RECORDER" "AND PRESS P.":REPEAT:UNTIL GET=80
  70 ch=OPENIN("MYLOGS")
  80 INPUT#ch,DT
  90 FORN=1 TO DT
 100 INPUT#ch,DT$(N,0)
 110 INPUT#ch,DT$(N,1)
 120 PRINTDT$(N,0),DT$(N,1)
 130 NEXT
 140 CLOSE#ch
 150 MODE 4
 160 PROCSCR:PLOT4,640,412:GOSUB 2190
 170 REPEAT
 180 PROCINP
 190 CN=V1:CM=V2:IF CN<100 THEN PROCACT(CN,CM,V$)
 200 D$(0)=STR$(CN)+" "+STR$(CM)+" "+STR$(AG)
 210 VDU 7
 220AX1=AX:AY1=AY:GA1=GA:AX=(256*(?&33E)+?&33F:AY=(256*(?&33C))+?&33D:GA=
AG
 230 NMO=NM:TRO=TR:SZO=SZ
 240 IF CN>100 THEN CN=CN-100:SC=0:S$(0)=DT$(CN,1):REPEAT:PROCEX:UNTIL SC(
0
 250 UNTIL QU=1
 260 MODE7:PRINT"DO YOU WANT TO SAVE THIS VERSION ?"
 270A=GET:IF(A<>78 AND A<>89) THEN 270 ELSEIF A=78 THEN 380
 280 PRINT"PUT BLANK TAPE IN RECORDER""AND PRESS R.":REPEAT:UNTIL GET=82
 290 ch=OPENOUT("MYLOGS")
 300 PRINT#ch,DT
 310 FORN=1 TO DT
 320 PRINT#ch,DT$(N,0)
 330 PRINT#ch,DT$(N,1)
 340 PRINTDT$(N,0),DT$(N,1)
 350 NEXT
 360 CLOSE#ch
 380 *FX 15 ,0
 390 PRINT"DO YOU WANT TO GO BACK TO THE PROGRAM ?"
```

(continued below)

TURTLE

trace output in the direction of the current angle.

Repeat and Next define a repeat loop. Define and End Define delineate a user-defined command. Delete removes a defined command from the system. Describe describes a defined command. Edit allows editing of a command, each term of a command is presented with options of Entering that term, Deleting that term, replacing that term, Inserting a term before the presented term or abandoning the definition. A useful way of turning the screen off while defining a command is to define the command without any terms, then insert the definition using the editor.

System lists the system command available, List lists the defined commands. Undo attempts to undo the last command given. Value lists the values of the three Logo variables Number, Turn and Size.

Now for the program and, to paraphrase Arthur Dent, do not panic. Although the program is 10K of listing, it is not spaghetti-written. This does not necessarily mean that it always conforms to structural programming conventions. A workable, testable version can be produced with a small amount of effort and built up from there.

Begin typing in the driver routine between lines 150 and 250. Add the initialisation procedures ProcInt and ProcScr. The utility routines ProcStrip and ProcFind. ProcStrip removes the front spaces from strings and indicates the place where it can be divided to give a string containing the first value. ProcFind looks for a string among the system commands and defined commands. It returns 0 if no such command exists, a value less than 30 for a system command and a value greater than 100 for a defined command.

(continued on page 67)

Command	Mnemonic	Parameter
Clear screen	CL	—
Home cursor	HM	—
Pen up	PU	—
Pen down	PD	—
Fill	FL	—
End Fill	EF	—
Cursor on	ON	—
Cursor off	OFF	—
Quit	QU	—
Cursor right	CR	N
Cursor left	CL	N
Right turn	RT	N
Left turn	LT	N
Angle	AG	N
Forwards	FD	N
Backwards	BD	N
Repeat	RP	N
Next	NX	—
Define	DF	$
End Define	EN	—
Edit	ED	$
Describe	DS	$
Delete	DL	$
System	SY	—
List	LI	—
Undo	UD	—
Values	VL	—
Number	NM	N
Turn	TR	N
Size	SZ	N

Table 1.

(continued from top of page)

```
 400 A=GET:IF (A<>78AND A<>89)THEN 400 ELSE IF A=78 THEN END
 410 GOTO 150
 420 DEFPROCSCR
 430 QU=0:HO=0
 440 VDU 28,0,31,39,26
 450 VDU 24,0;200;1279;1023;
 460 VDU 29,0;200;
 470 ENDPROC
 480 DEFPROCINT
 490 DIM$(30),S$(100),DT$(50,2)
 500 AG=0:ED=0:DD=0:NM=10:TR=90:SZ=10
 510 RESTORE 520:FORN=1 TO 30:READ T$:D$(N)=T$:NEXT
 520 DATA CL,HM,PU,PD,FL,EF,CR,CU,LT,RT,BD,FD,RP,NX,DF,EN,UD,SY,LI,ED,DS,D
L,DU,AG
 530 DATA VL,DN,DF,NM,TR,SZ
 540 FLF=0:PD=1:DF=0:RP=0:SC=0:DT=1:ED1=0:QU=0:AX=640:AY=412:GA=0
 550 ENDPROC
 560 DEFPROCINP:V2=0
 570 INPUT"Command "I$:IF I$="" THEN 570 ELSE PROCSTRIP(I$)
 580 I$=MID$(I$,U+1)
 590 PROCFIND(U$):N=FDF
 600 IF RP=1 AND N=13 THEN PRINT"** already repeating. **":GOTO 570
 610 IF RP=0 AND N=14 THENPRINT"** not repeating **":GOTO 570
 620  IF RP=1 AND N>14 AND N<24 THEN PRINT"** repeating can't use ";D$(N);
" **":GOTO 570
 630 IF DF=1  AND N=15 THEN PRINT"** already defining. **":GOTO 570
 640 IF DF=0 AND N=16 THEN PRINT"** not defining **":GOTO 570
 650 IF DF=1AND N>17 AND N<26 THEN PRINT"** defining can't use ";D$(N);" *
*":GOTO 570
 660 IF N=0THEN PRINT"**sorry don't understand. **":GOTO 570
 670 IF(N>6AND N<14)OR(N=24)OR(N>27 AND N<31) AND (I$="" )THEN PRINT"** I
need anumber for that **"+GOTO570ELSE IF(N>6AND N<14)OR(N=24)OR(N>27 AND
N<31)THEN V2=EVAL(I$)
 680 V1=N:V$=I$:IF(I$="" "OR I$="")THENV$="0":VDU7
 690 ENDPROC
 760 DEFPROCACT(PT,PN,P$)
 810 IF PT=0  THEN  ENDPROC
 820 ON PT  GOSUB 840,850,860,870,880,890,900,910,920,930,960,970,1020,950
,1000,950,1100,1190,1200,1210,1300,1470,1520,1530,1540,1550,1560,1570,1590,
1610
 830 ENDPROC
 840 CLS:AG=0:PLOT4,640,412:GOSUB2190:RETURN
 850 GOSUB 2190:PLOT4,640,412:AG=0:GOSUB 2190:RETURN
 860 PD=0:RETURN
 870 PD=1:RETURN
 880 FLF=1:RETURN
 890 FLF=0:RETURN
 900 X1=10*PN:Y1=0:PROCTUR(0,X1,Y1):RETURN
 910 Y1=10*PN:X1=0:PROCTUR(0,X1,Y1):RETURN
 920 PN=-PN
 930 GOSUB2190:AG=AG+PN:IF AG>360 THEN AG=AG-360 ELSE IF AG<0 THEN AG=AG+3
60
 940 GOSUB 2190
 950 RETURN
 960 PN=-PN
 970 X1=(SIN(RAD(AG)))*PN*10:Y1=(COS(RAD(AG)))*PN*10
 980 IF PD=0 THEN PROCTUR(0,X1,Y1):RETURN
```

(listing continued on page 67)

NEW BOOKS from Prentice-Hall International

ATARI® Games and Recreations

Herb Kohl, Ted Kahn and Len Lindsay

Preprogrammed games, charts, flash cards and graphs are included in this fun-packed book for beginners and advanced users of the ATARI 400 and 800. A special section covers graphics, sound and colour features.

☐ **£11.95 338 pages 8359-0242-0**

ATARI® Pilot for Beginners

Jim Conlan and Tracy Deliman

Full instructions and programs for using the new computer language PILOT on the ATARI 400 and 800 are given. PILOT is designed to let beginners program quickly through games and experimentation, to create music, moving colour pictures and many types of games with ease.

☐ **£11.95 230 pages 8359-0301-X**

The VisiCalc Book: ATARI® Edition

Donald Beil

Illustrated with practical problems, this book explains how to make full use of VisiCalc on the ATARI. All examples have been prepared on the ATARI 800 using VisiCalc 1.74A. Among the many topics covered are capabilities, commands, built-in functions, errors and documentation.

☐ **£11.95 312 pages 8359-8393-5**

The Apple Personal Computer for Beginners

Seamus Dunn and Valerie Morgan

This thorough introduction to the Apple II series concentrates on Applesoft BASIC and disk-oriented machines. Graphics, colour and sound are given particular emphasis, and appendices cover Integer BASIC, Pascal and the use of tape-recorder and cassette storage.

☐ **£6.95 300 pages 13-039131-X**

Kids and the Apple

Edward Carlson

Cartoons illustrate this lively guide for children which teaches Applesoft BASIC on disk-based or cassette Apple systems.

☐ **£15.95 224 pages 8359-3669-4**

BASIC Programming on the BBC Microcomputer

Neil and Pat Cryer

"an excellent introduction to the BBC Microcomputer. It teaches BBC BASIC in a non-technical, easy-to-understand way, ideal for the beginner." *Practical Computing.*

"the explanations are clear and there are plenty of sample programs." *Computing Today.*

☐ **£5.95 208 pages 13-066407-3**

Programming the TI-55 Slide Rule Calculator

Stephen Snover and Mark Spikell

Over 125 examples, exercises and problems are included in this practical handbook, which explains how to program the TI-55 to solve mathematical, scientific, financial and business problems. The step-by-step instructions allow the programs to be adapted to suit other programmable calculators.

☐ **£6.35 116 pages 13-729913-3**

TRS-80 Color Computer Graphics

Don Inman with Dymax

16K Extended Color BASIC graphics features are explained for low, medium and high resolution graphics, as well as the 64-by-32 mode implemented in the 4K Color BASIC machine. Programs and exercises illustrate the step-by-step instructions provided.

☐ **£11.95 308 pages 8359-7864-8**

Prices and publication dates are correct at the time of going to press, but may be subject to change.

Book Orders

These books can be ordered from your usual bookseller, or in case of difficulty from:

Department 30,
Prentice-Hall International,
66 Wood Lane End, Hemel Hempstead,
Hertfordshire, HP2 4RG, England.

Please mark the number of books you wish to order in the boxes beside each title and return the advertisement to the address above.

Name _____

Address _____

_____

_____

I enclose a cheque/P.O. for £_____ Please add £1.00 per book for postage and packing. Payment should be made out to **INTERNATIONAL BOOK DISTRIBUTORS.** Please allow 28 days for delivery.

YC1

Prentice-Hall International

(listing continued from page 65)

```
998 IF FLF>0 THEN FLF=FLF+1
1000 PL=1: PROCTUR(PL,X1,Y1)
1010 RETURN
1020 RP=:RT$=STR$(13)+" "+STR$(PN-1)+" ":REPEAT
1021 PROCINP
1030 RT$=RT$+STR$(V1)+" "+V$+" "
1050IF V1<100 THEN PROCACT(V1,V2,V$) ELSE :SC=0:S$(0)=DT$(V1-100,1):REPEAT
:PROCEX:UNTIL SC<0
1060 UNTIL V1=14:TRT$=RT$+STR$(16)+" "+STR$(0):RP=0:IF ED=0:S$(0)=TRT$:SC=
0:REPEAT:PROCEX:UNTIL SC<0
1070 RETURN
1080 PROCSTRIP(P$):IF P$="0" THEN PRINT"## you need to give it a name ! ##
":RETURN
1090 PROCFIND(P$):IF FDF=0 THEN 1110 ELSEDF=0:IF FDF<100 THEN PRINT"## ";P
$;" is a system command ##":ELSE IF FDF-100=DT AND ED1=0 THEN PRINT"## you
are still defining ";P$;" ##"
1100 IF FDF-100=DT AND ED1=0 THEN PRINT"## you have already defined ";P$"
##":RETURN
1110 IF DT=50 THEN PRINT"## my chips are full ##":R.
1111 DF=1:P$=U$:DT$(DT,0)=P$:DT$(DT,1)="":REPEAT
1120 PROCINP: IF V1-100=DT THEN PRINT"## you are still defining ";DT$(DT,0
);" ##":GOTO 1120
1130 DT$(DT,0)=DT$(DT,1)+STR$(V1)+" "+V$+" "
1150 IF V1<100 THEN PROCACT(V1,V2,V$):IF V1=14 THEN FORN=0 TO1:PROCSTRIP(R
T$):RT$=MID$(RT$,U+1):NEXT:DT$(DT,1)=DT$(DT,1)+RT$
1160 IFV1>100 THENS$(0)=DT$(V1-100,1):SC=0:REPEAT:PROCEX:UNTIL SC<0
1170UNTIL V1=16:DT=DT+1:DF=0:RETURN
1180 PROCUNDO:RETURN
1190 CLS:VDU 14:FORN=1 TO 30:PRINTD$(N);SPC(0);:NEXT:VDU 15:R=GET:CLS:RETU
RN
1200 CLS:VDU 14:N=0:REPEAT:N=N+1:PRINTTAB((N-1 MOD 3)*10);DT$(N,0);:UNTIL
(N=50 OR DT$(N,0)="");VDU 15:R=GET:CLS:RETURN
1210IF P$="0"THEN PRINT"##edit what ? ##":RETURN:ELSE PROCFIND(P$):IF FDF=
0 THEN PRINT"## I don't recognise ";P$;" ##":RETURN:ELSE IFFDF<100 THEN PRI
NT"## that's a system command ##":RETURN:ELSE GOTO 1230
1220 ED=1: CLS:PRINT"D elete""E nter""R eplace""I nsert""A bandon":VDU
28,10,31,39,26
1230 ED$=DT$(EDF,1):TED$=""
1240 REPEAT
1250 PROCPRINTF(ED$):ED1=VAL(U$):ED$=MID$(ED$,U+1):PROCSTRIP(ED$):ED$=MID$(
ED$,U+1):ED2$=U$
1260 IF ED1<100 THEN PRINTD$(ED1);" ";ED2$:ELSE PRINTDT$(ED1-100,0)
1270 REM:IF(RC>6B AND RC>65 AND RC>69 AND RC>73 AND RC>82)THEN 1270
1280 IF R=65 THEN 1310:ELSE IF R=68 THEN 1290 ELSE IF R=69 THEN GOSUB 1320
:GOTO 1250: ELSE GOSUB 1350:IF R=73 THEN GOTO 1260 ELSE GOTO 1250
1290 IF RP=1 AND (ED1=16 OR V1=16) THEN PRINT"## still repeating can't end
##":GOTO 1260
1291 UNTIL(ED1=16 OR V1=16)
1300 DT$(EDF,1)=TED$
1310 ED=0:VDU 28,0,31,39,26:CLS:RETURN
1320 TED$=TED$+STR$(ED1)+" "+ED2$+" "
1330 IF ED1=13 THEN RP=1 ELSE IF ED1=14 THEN RP=0
1340 RETURN
1350 PROCINP:IF V1=13 THEN RP=1 ELSE IF V1=14 THEN RP=0
1360 IF LEN(V$)<2 THEN 1370 ELSE IF((INSTR(V$,"MT")>0)OR(INSTR(V$,"TR")>0)
OR(INSTR(V$,"SZ")>0))THEN TED$=TED$+STR$(V1)+" "+V$+" ":RETURN
1370 TED$=TED$+STR$(V1)+" "+V$+" ":RETURN
1380 IF P$="0" THEN ED1=1:PRINT"## what command ? ##":RETURN
1390 PROCFIND(P$):IF FDF=0 THEN PRINT"## don't recognise ";P$;" ##":RETURN

1400 IF FDF<100 THEN PRINT"## that's a system command ##":RETURN
1410 FDF =FDF-100
1420 DC$=DT$(FDF,1):REPEAT PROCSTRIP(DC$):DS1=VAL(U$):DC$=MID$(DC$,U):PROC
STRIP(DC$):DS2=VAL(U$):DC$=MID$(DC$,U)
1430 IF DS1<100 THEN PROCTUR(DS1);" ",";U$;" #";:ELSE PRINTDT$(DS1-100,0);"
#";
1460 UNTIL DS1=16:PRINT:RETURN
1470 IF P$="0" THEN PRINT"## what command ? ##":RETURN:ELSE PROCFIND(P$):I
F FDF=0 THEN PRINT"## I don't know ";P$;" ##":RETURN:ELSE IF FDF <100 THEN
PRINT"## that's a system command ##":RETURN
1480 C=0:FDF=STR$(FDF)+" 0 ":REPEAT:C=C+1
1490 UNTIL ((INSTR(DT$(C,1),FDF$)>0) OR(C=DT-1))
1500 IF(C<DT-1) OR INSTR(DT$(DT-1,1),FDF$)>0THEN PRINT"## can't needed by
";DT$(C,0);" ##":RETURN
1510 NX=FDF-100:REPEAT:DT$(NX,0)=DT$(NX+1,0):DT$(NX,1)=DT$(NX+1,1):NX=NX+1
:UNTIL NX>=DT:DT=DT-1
1511 CX=0:REPEAT CX=CX+1
1512 T$="":REPEAT:PROCSTRIP( DT$(CX,1)):DT$(CX,1)=MID$(DT$(CX,1),U):TX=VAL
(U$)
1513 IF TX<FDF THEN T$=T$+" "+STR$(TX) ELSE T$=T$+" "+STR$(TX-1)
1514 PROCSTRIP(U$+DT$(CX,1)):DT$(CX,1)=MID$(DT$(CX,1),U):T$=T$+" "+U$+" "
1515 UNTIL TX=16
1516 DT$(CX,1)=T$:UNTIL CX=DT-1:RETURN
1520 QU=1:RETURN
1530 GOSUB 2190:A6=PN:GOSUB 2190:RETURN
1540:PRINTTAB(5);"## NM= ";NM;TAB(15)" ##""TAB(5);"## TR= ";TR;TAB(15)" ##
""TAB(5);"## SZ= ";SZ;TAB(15)" ##":RETURN
1550 IF HD=0 THEN RETURN ELSEHD=0:GOSUB2190:RETURN
1560 GOSUB2190:HD=1:RETURN
1570 NM=EVAL(P$)
1571 RETURN
1590 TR=EVAL(P$)
1600 RETURN
1610 SZ=EVAL(P$)
1620 RETURN
1690 DEFPROCEX
1695 IF SC=100 THENPRINT"## my chips are full ##":ENDPROC
1700 TX$=S$(SC):PROCSTRIP(TX$):E1=VAL(U$):TX$=MID$(TX$,U):PROCSTRIP(TX$):E
2=VAL(U$):TX$=MID$(TX$,U)
1710 IF(E1>AND(E1<14)ORE1=24ORE1>27 THEN E2=EVAL(U$)
1720 IF E1=16 THEN S$(SC)="":SC=SC-1:GOTO 1760
1730 IF E1=13 AND E2>1 THEN 1770 ELSE IF E1=13 THEN S$(SC)=TX$:GOTO1760
1740 IF E1>100 THEN 1800
1750 PROCACT(E1,E2,U$):S$(SC)=TX$:GOTO 1760
1760 ENDPROC
1770 RX$="":RY$=TX$:REPEAT:PROCSTRIP(RY$):E3=VAL(U$):RY$=MID$(RY$,U):RX$=R
X$+U$+" ":PROCSTRIP(RY$):E4=VAL(U$):RY$=MID$(RY$,U):RX$=RX$+U$+" ":UNTIL E3
=14
1780 EP=INSTR(RX$," 14 0"):RX$=LEFT$(RX$,EP-1):RX$=RX$+" 16 0# ":S$(SC+1)=
RX$
1790 E2=E2-1:TX$=TX$+"13"+STR$(E2)+TX$:S$(SC)=TX$:SC=SC+1:GOTO 1760
1800 S$(SC+1)=DT$(E1-100,1):S$(SC)=TX$:SC=SC+1:GOTO 1760
1810 DEFPROCSTRIP(ST$):U$=0
1820 IF ASC(ST$)=32 THEN ST$=MID$(ST$,2):UU=UU+1:GOTO 1820
1830 U$="":U=0:REPEAT:U=U+1:IF ASC(MID$(ST$,U,1))<>32 THEN U$=U$+MID$(ST$,
U,1)
1840 UNTIL (MID$(ST$,U,1)=" " OR U>LEN(ST$))
1850 U=U+UU
1860 ENDPROC
1880 DEFPROCFIND(FD$):FDF=0:PROCSTRIP(FD$):FD$=U$
1890 N=0:REPEAT:N=N+1:UNTIL(FD$=DT$(N,0) OR N=50):IF FD$=DT$(N) THEN FDF=N
1900N=0:REPEAT:N=N+1:UNTIL(FD$=DT$(N,0) OR N=DT):IF FD$=DT$(N,0) THEN FDF=
N+100
1910 ENDPROC
1920 DEFPROCUNDO:THD=HD:UU=1:GOSUB 2190:HD=1:NM=NMD:TR=TRD:SZ=SZD
1930 PROCSTRIP(D$(0)):UD1=VAL(U$)
1940 IF UD1>100 THEN S$(0)=DT$(UD1-100,1):PLOT4,AX,AY:SC=0:REPEAT:PROCEX:U
NTIL SC<0:GOTO 2000
1950 IF (UD1=1 OR UD1=15 OR UD1=17OR UD1>18 AND UD1<>24) THEN PRINT"## can
't undo ";D$(UD1);" ##":GOTO 2000
1960 T$=MID$(D$(0),U):PROCSTRIP(T$):UD2=VAL(U$):T$=MID$(T$,U)
1965 GOSUB 2190:PLOT4,AX,AY:GOSUB 2190
1968 IF UD1=2 THEN GOSUB2190:PLOT4,AX1,AY1:A6=GA1:GOSUB2190
1970 IF UD1=3 THEN PU=1
1980 IF UD1=4 THEN PU=0
1990 IF UD1=5 THEN FL=0
2000 IF UD1=6 THEN IF FL=1:FL=0:ELSE FL=2
2010 IF UD1=7 THEN PROCACT(7,-UD2,"")
2020 IF UD1=8 THEN PROCACT(8,-UD2,"")
2030 IF UD1=9 THEN PROCACT(9,-UD2,"")
2040 IF UD1=10 THEN PROCACT(10,-UD2,"")
2050 IF UD1=11 OR UD1=12THEN GOSUB 2090
2060 IF UD1=13 AND DF=1 THEN PRINT"## EN definition and redefine ##"
2070 IF UD1=16 THEN PRINT"## EN DeLete definition ##"
2075 IF UD1=24 THEN GOSUB2190:A6=GA1:GOSUB2190
2080 HD=THD:GOSUB 2190:UD=0:NM=NMD:TR=TRD:SZ=SZD:ENDPROC
2090 T$=DT$(0,1):PROCSTRIP(T$):X1=VAL(U$):T$=MID$(T$,U+1):PROCSTRIP(T$):Y1
=VAL(U$)
2100 T$=DT$(0,0):PROCSTRIP(T$):X2=VAL(U$):T$=MID$(T$,U+1):PROCSTRIP(T$):Y2
=VAL(U$)
2110 FLF=FLF-1
2120 DT$(0,1)=D$(0,0)
2130 IFFLF<=1 THEN PLOT3,-X1,-Y1:GOTO 2160
2140 PLOT0,-X1,-Y1:PLOT03,-X2,-Y2
2150 PLOT1,X2,Y2
2160 RETURN
2170 DEFFNCAN(Z):=Z*COS(RAD(AN))
2180 DEFFNSAN(Z):=Z*SIN(RAD(AN))
2190 IF HD=1 THEN RETURN
2200 GCO0,3
2210 AN=AG:Z=25:VVX=FNSAN(Z):WWX=FNCAN(Z):PLOT1,VVX,WWX:PLOT0,VVX,WWX
2220 AN=AG+220:Z=25:VX=FNSAN(Z):WX=FNCAN(Z):PLOT0,VX,WX:PLOT0,-VX,-WX
2230 AN=AG+140:Z=25:VX=FNSAN(Z):WX=FNCAN(Z):PLOT0,VX,WX:PLOT0,-VX,-WX
2240 PLOT0,2*-VVX,2*-WWX
2250 GCO0,1
2260 RETURN
2270 DEFPROCTUR(PL,X,Y)
2280 IF(T>YGOR T<1) THENTAG=AG:AG=A6-PN:GOSUB2190:AG=AG+PN:GOSUB2190:ENDP
ROC
2290 GOSUB2190
2300 IF U=1 AND PL=1 THEN PL=3
2310 PLOTP1,X,Y
2320 GOSUB 2190
2330 DT$(0,0)=DT$(0,1):DT$(0,1)=STR$(X)+" "+STR$(Y)
2340 IF FLF>=3 THEN GOSUB 2370
2350 ENDPROC
2370 T$=DT$(0,1):PROCSTRIP(T$):X2=VAL(U$):T$=MID$(T$,U+1):PROCSTRIP(T$):Y2
=VAL(U$)
2380 T$=DT$(0,0):PROCSTRIP(T$):X3=VAL(U$):T$=MID$(T$,U+1):PROCSTRIP(T$):Y3
=VAL(U$)
2390 IF UD=1 THEN PL=03 ELSE PL=B1
2400 PLOT0,-X2,-Y2:PLOT0,-X3,-Y3
2410 PLOT0,X3,Y3:PLOT PL,X2,Y2
2420 RETURN
2500 REM
2505IFERR=26ANDERL=470THENPRINT"### SERIOUS ERROR ###":IFED=1THEN 2560 EL
SE IF DF=1 THEN 2520 ELSE IF RP=1THEN 2540 ELSE 2600
2510 PRINT"ERROR NUMBER ";ERR;" AT LINE ";ERL:END
2520 PRINT"## DEFINITION ABANDONED ##":GOTO 2600
2540 PRINT"## REPEAT ABANDONED ##":GOTO 2600
2560 PRINT"## EDIT ABANDONED ##":GOTO 2600
2600 PRINT"## DON'T DO IT AGAIN ##":R=GET:VDU 28,0,31,39,26:CLS:DF=0:RP=0:
ED=0:DT(DT,0)="":GOTO 170
```

(continued from page 65)

ProcTur controls plotting lines on the screen and the subroutine called at line 2190 controls the cursor on the screen.

Following this, two of the major routines can be introduced. The ProcInp accepts the commands and passes its results to the major procedure ProcAct. This consists of a Gosub stack which calls routines corresponding to the 30 allowed terms. The simple screen-handling commands can now be keyed in. This will give a minimal system capable of executing commands immediately on the screen.

The system can now be extended by adding the structures that allow it to be described as a language, the Repeat loop, and the definition routine depend upon the ProcEx procedure.

There only remain the parts that make life easier: the Editing, Description Delete and Quit routines to complete the system.

The main variables of the program, besides the flags, are the arrays. D$(30) holds the mnemonics for the system commands. The arrays DT$(50,2) holds the defined command names in DT$(DT,0) and their representation in DT$(DT,1). DT is the defined command counter.

The definition of a command is held in the array as a sequence of pairs of strings. The first string of the pair holds the mnemonic number as described in ProcFind, the second string holds a dummy value 0 or a simple numerical value or a term that will give a numerical result when passed to the Basic's Eval function. This is made clearer by an example.

Suppose you defined your first term QSQ as FD NM*.8 // RT 90 this would be stored in DT$(1,1) as " 12 NM*.8 10 90". The command SQ defined as RP 4//QSQ//NX would be stored as "13 4 101 14 0".

The execution of a defined term or a repeat loop is handled by ProcEx; this controls the stack S$(100). The string to be executed is placed on the bottom of the stack and is stripped of pairs of values to be passed to ProcEx. If a repeat loop or a defined term is

(continued on page 69)

MICROWARE — UNIT 5, ST. PETERS LANE, LEICESTER. Tel: 0533 29023
(Close to Clock Tower, Large Car Parks and Bus Station)

THE "FRIENDLY TO USER STORE" THE FIRST MIDLANDS REGION RETAIL SHOP SPECIALISING IN SINCLAIR COMPUTER ACCESSORIES

ZX81 (NOW IN STOCK) £49.95
JUPITER ACE (NOW IN STOCK £89.95
ORIC (AVAILABLE END JAN)
SPECTRUM (COMING SOON)

ALSO SUPPORTING SOFTWARE AND HARDWARE
Come and see our ever increasing range of Software . Hardware . Books . Magazines . Keyboards . Ram Packs . Graphic Roms . I/O Ports . etc.

BOOKS AND GOOD RANGE OF SOFTWARE FOR BBC & DRAGON 32

IF THE PRODUCT IS GOOD AND THE PRICE IS RIGHT — THEN MICROWARE STOCK IT!

QUALITY JOYSTICKS FOR DRAGON & BBC **£9.99 EA.**
VINYL DUSTCOVERS FOR DRAGON & BBC **£4.50**

MICROWARE SPECTRUM SOFTWARE

ALIEN COMMAND (16K) Testing Invaders style game making full use of Spectrum sound, colour and graphics NOW £4.75 ONLY
BACKGAMMON (16K) Play against your computer in this version of the popular board game £5.00

BOTH GAMES AVAILABLE FROM SHOP OR MAIL ORDER

SOFTWARE WRITERS!
GOOD SOFTWARE WANTED — EXCELLENT ROYALTIES

PRINTER FOR DRAGON, BBC,ETC **£150**

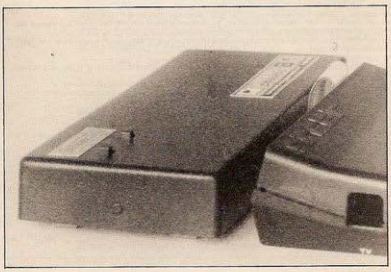
TRADE ENQUIRIES WELCOME OPEN 9.30-12 noon 12.30-5.30 pm Closed Monday SAE BRINGS CATALOGUE

MICROWARE Leicester

CRAMIC-81 a 16K Rampack with internal battery

It lets you banish the Whit, Click, Wait and Try agains of ZX81 Systems

* Latest technology CMOS memories. Use only a tiny current to retain data.
* State-of-the-art Lithium battery provides current for 10 years without charging. Powers off the ZX81 when running.
* Use it like an ordinary Rampack on it's own, or together with a Rampack like two PAGES of memory.
* Flick a Switch and your data is saved. Remove it and put it in your briefcase or send it for a trip around the world! Plug it on and hit the right keys and there's your program again.
* You can even run two independent interleaved programs from the two Rampacks.
* Expansion adaptor on rear of elegant lie-flat ABS case. Cabled connector to ZX81.



£79.95

ALSO NEW * DREAM-81, a 64K Rampack for ZX81 with 16K EPROM socket. This versatile unit has many features. Cased, professionally built and tested .....**£69.95** + VAT

OTHER CAMEL PRODUCTS * .....
MEMIC 81(.2) 2 kB (4 kB) CMOS memory unit with Lithium battery backup. Instant storage/retrieval £24.95 (29.95)

PPS a fully cased 25W Personal Power Source for Small production runs, labs and hobbyists. Outputs 5v,3A/12v,1A/-12V,.25A **£44.95** + VAT

MEMIC L a kB CMOS unit with Lith.battery backup and 24 pin cabled header from EPROM Socket on any system **£26.05**

ROM-81 2kB-8kB EPROM unit with Wait States **£14.95**

PIO-81 an 8+8 Channel, latched Input/Output card with TTL compatibility £13.00

Printer Stands + Output trays Please ask for details

Cambridge Microelectronics Ltd., One Milton Rd., Cambridge CB4 1UY Tel (0223) 314 814

P + P free except on printer accessories
VAT extra on all products.

(continued from page 67)

encountered then the relevant string is placed on top of the stack and execution of the stack moves up one level.

In operation, the program, operating system RAM and screen memory occupy 22K of your 32K. This leaves 10K for the program variables and the stack.

It is possible to use up all of this memory before the reserved limit of 50 defined terms and 100 stack levels is fully used. Despite this you may wish to add further system commands. Commands to change foreground and background colours could easily be added by adding subroutines to the subroutine stack.

HOW TO TALK TURTLE

David Peckett's programs allow you to test the water before taking the turtle plunge.

THE ESSENCE of turtle graphics is the "turtle" concept. Imagine a mechanical turtle, crawling over a sheet of paper, drawing a line as it goes. It can do two main things: it can go forward for any distance you may wish, and it can turn right through any angle — a negative angle is the same as a left turn. With these two functions, it is easy to make the turtle draw complex patterns; for instance, the imaginary command sequence:

FWD(10) TURN(90) FWD(10) TURN(90)
FWD(10) TURN(90) FWD(10) TURN(90)

would draw a square of side length 10, leaving the turtle back where it started, facing in the original direction. Try it on a piece of paper.

This simple example should hint at how more complex patterns can be generated. There are, however, several important points about the way in which turtle graphics acts which may not be immediately obvious.

The pattern is drawn from wherever the turtle may be at the start — it takes absolutely no notice of the screen's co-ordinate system. This makes it very easy to draw any pattern anywhere; once you have written a routine to draw the shape you want — the difficult part — you can put the turtle in the correct starting position and set it off. This goes even further, since the pattern may be drawn at any angle, because the turtle simply starts moving in the direction in which it is pointing. Put it in the middle of the screen, turn it right 45° and set it running to draw a diamond.

Turtle graphics make it easy to scale the size of a pattern as well. Suppose in the previous example we had used

FWD(n) TURN(90)

that would draw a square of side length n at any angle, anywhere on the screen.

The final major benefit of turtle graphics is the ease with which routines may be debugged. At its simplest, you can "play turtle". Walk and turn as the program specifies and see if your footsteps trace out the pattern you wanted them to. If they do not, the bug should be obvious immediately. This technique appeals particularly to children of all ages, who can have great fun debugging turtle graphics routines.

What facilities do we need from a turtle graphics system? Obviously, there must be commands to instruct the turtle to go forwards and to turn. There must also be a way to put the beast anywhere on the screen, facing in any direction. Sometimes, we may wish to move the turtle without drawing a line, and so we need ways to switch its pen on and off. Also, since we are using a BBC Micro, there must be a way of changing the Ink colour.

Additionally, it would be useful if we could control more than one turtle simultaneously. The Apple turtle graphics system does not allow this, but it might be very helpful in games to be able to move turtles simultaneously.

As a final refinement, the turtle graphics system should allow us to write any message on the screen at the turtle's present position, without affecting that position.

Take a look now at listing 1, which is a set of procedures to implement all these requirements. Their names are in line with the general run of turtle graphics commands.

Note that the listing does not show the arrays which are used in conjunction with the procedures. You need five to support the system:

TRTLX(n) and TRTLY(n)

which contain the turtles' positions in absolute screen co-ordinate terms while

TRTLA(n)

holds the angle at which each turtle is facing, using the convention of "up is 0" and recording the angles in degrees clockwise.

TRTLCOL(n)

holds the logical colour number selected for each turtle — you can alter the logical colours by the usual VDU 19 command. Finally,

TRTLDOWN(n)

is an array whose elements are set to 1 to show that the associated turtle is writing, or 0 if its pen is up. The dimension of all of these arrays, given by "n" represents, of course, how many turtles are available.

Remember, though, that having dimensioned the arrays at the start of your program, there is no need to refer to them again. The procedures in listing 1 keep them completely up to date.

All the procedures have a common syntax, which is of the form

PROname(n,d1. .)

The first item in the brackets is the number of the turtle which is to be addressed. It is followed by the appropriate number of items of data; in most cases, there are no data items, or only one, but the positioning commands

PROCTRTLMOVE AND PROCTRTLSET

take more items of data.

The procedures are thoroughly explained by Rem statements and should be easy to follow, but let us take a closer look at what each one does.

ProcTrtlInt. This procedure simply sets the selected turtle up to a standard starting position. It goes to the centre of the screen, facing up, with its pen down and ready to draw a white line. You would normally use this procedure at the start of a graphics run, but it can be called at any time; the turtle goes straight to the start position, from wherever it may be, without drawing a line.

ProcTrtlMove. This is one of the two fundamental turtle graphics instructions. It

(continued on next page)

Listing 1.

```
L.
10000 REM** BBC Turtlegraphics routines
10010 REM** 26 Sep 1982. by D S Peckett
10020
10030 REM** Put turtle "tno" in centre of screen, pointing up, pen down.
10040 REM** and ready to draw in white
10050 DEF PROCTRTLINIT(tno)
10060 PROCTRTLSET(tno,640,512,0):REM** Position and angle
10070 PROCTRTLPENDOWN(tno):REM** Put the pen down
10080 PROCTRTLPENCOL(tno,7):REM** 7 will select white in any mode
10090 ENDPROC
10100
10110 REM** Move turtle "tno" for "td" units in the direction it is facing.
10120 REM** Keep a record of the position if it goes over the screen edges.
10130 DEF PROCTRTLMOVE(tno,td)
10140 tx=TRTLX(tno)+td*SIN(RAD(TRTLA(tno))):REM** Get the new x-axis position
10150 ty=TRTLY(tno)+td*COS(RAD(TRTLA(tno))):REM** and the y-axis position
10160 PROCTRTLMOVETO(tno,tx,ty):REM** Actually move it
10170 ENDPROC
10180
10190 REM** Move turtle "tno" to (tx,ty), drawing a line in the selected
10200 REM** colour if the "pen" is "down".
10210 DEF PROCTRTLMOVETO(tno,tx,ty)
10220 GCOL 0,TRTLCOL(tno):REM** Select the foreground colour for this turtle
10230 MOVE TRTLX(tno),TRTLY(tno):REM** Put cursor at turtle's current position
10240 PLOT 4+TRTLDOWN(tno),tx,ty:REM** Draw the line, if pen is down
10250 TRTLX(tno)=tx:REM** Reset...
10260 TRTLY(tno)=ty:REM** ..the pointers
10270 ENDPROC
10280
10290 REM** Turn turtle "tno" through "ta" degrees in a clockwise direction.
10300 DEF PROCTRTLTURN(tno,ta)
10310 ta=ta+TRTLA(tno):REM** Get new angle
10320 PROCTRTLTURNTO(tno,ta):REM** Actually set it to the new angle
10330 ENDPROC
10340
10350 REM** Set turtle "tno" to point at angle "ta".
10360 DEF PROCTRTLTURNTO(tno,ta)
10370 ta=ta MOD 360:REM** One revolution only
10380 IF ta>180 THEN ta=ta-360:REM** Adjust the range of angles...
10390 IF ta<-180 THEN ta=ta+360:REM** ...to -180 to +180
10400 TRTLA(tno)=ta:REM** Set it
10410 ENDPROC
10420
10430 REM** Position a turtle
10440 DEF PROCTRTLSET(tno,tx,ty,ta)
10450 TRTLX(tno)=tx
10460 TRTLY(tno)=ty
10470 TRTLA(tno)=ta
10480 ENDPROC
10490
10500 REM** Set turtle "tno" to be ready to draw
10510 DEF PROCTRTLPENDOWN(tno)
10520 TRTLDOWN(tno)=1
10530 ENDPROC
10540
10550 REM** Stop "tno" drawing a line as it moves
10560 DEF PROCTRTLPENUP(tno)
10570 TRTLDOWN(tno)=0
10580 ENDPROC
10590
10600 REM** Select a logical colour for turtle "tno" - usual BBC colour codes
10610 DEF PROCTRTLPENCOL(tno,tcol)
10620 TRTLCOL(tno)=tcol
10630 ENDPROC
10640
10650 REM** Write the string held in "tmess$" at position of turtle "tno"
10660 REM** without disturbing the turtle
10670 DEF PROCTRTLMESS(tno,tmess$)
10680 VDU 5:REM** Merge cursors
10690 MOVE TRTLX(tno),TRTLY(tno):REM** Position cursor
10700 PRINT tmess$;:REM** Print the message
10710 VDU 4:REM** Separate cursors
10720 ENDPROC
```

(continued from previous page)

moves the chosen turtle the defined distance in whatever direction it happens to be facing. The distance is given in terms of the standard BBC graphics layout of 1,280 by 1,024 — thus

PROCTRTLMOVE(2,640)

would move turtle 2 a distance equivalent to half the horizontal width of the screen. If the pen is down, the turtle will draw a line behind it in the selected colour.

ProcTrtlMoveTo. This procedure would normally only be used by ProcTrtlMove but is available at any time, if you insist on using it. It moves the turtle to a position defined by the BBC's normal X, Y system, drawing a line behind it as it goes.

ProcTrtlTurn. The second of the two fundamental turtle-graphics commands, this procedure turns the selected turtle through the given angle, which is defined in degrees. Any angle may be given, including those greater than 360°. Nothing is visible on the screen when you Turn, but the effect appears when the turtle is Moved.

ProcTrtlTurnTo. Like ProcTrtlMove To, this routine is intended for use with other procedures, but is available at any time for setting a turtle up to an absolute angle.

ProcTrtlSet. This routine sets a turtle to any absolute (X, Y) screen position and angle. The turtle moves without drawing a line, but it retains whatever Pen and Colour selections have been made.

ProcTrtlPenDown/Up. These two procedures instruct the selected turtle to start and stop writing respectively.

ProcTrtlPenCol. To choose the colour lines which a turtle is to draw, use this procedure. The colour is defined by a number representing a logical colour — which you may redefine to any true colour by the normal VDU 19 command — and the computer reacts as usual to colour numbers greater than those which are available in the current mode. For instance:

PROCTRTLPENCOL(1,2)

in Mode 0 will actually select logical colour 0, drawing the background colour and erasing whatever it may cross.

ProcTrtlMess. Finally, to write a message at the current position of any turtle, use this. It writes whatever is in the given string without moving the turtle.

You have probably realised that some of these procedures are, actually, redundant in the sense that it is quicker and easier to address the appropriate array directly. In particular, ProcTrtlPenDown/Up/Col can all be performed as simply, and slightly faster, by directly accessing the arrays. They are included, however, to make the set of procedures complete and compatible with any other turtle graphics systems you may come across.

It might be a good idea now to have a look at some examples of turtle graphics in action. Listing 2 gives a very basic, even crude, demonstration.

This is a simple program to draw a line around the screen under control of the left and right arrow keys. As written it will only run on a 32K machine, but it is easy to alter line 120 to, say, Mode 4 in order to get around that problem. The program uses just one turtle, which starts off in the middle of the screen, and then crawls forward.

The heart of the program is the Repeat Unit loop at lines 200-300. These lines repeatedly move the turtle forward and then check to see whether specific keys have been pressed. As you will see from the program the right arrow will turn the turtle right 5° on each pass through the loop, the left arrow will turn it left the same amount, and the U and D keys raise and lower the pen to switch the line off and on.

To change the colour, press C; the program will then wait for one of keys 0 to 7 inclusive to be pressed. Once one is pressed, the turtle will move off again, leaving a trail of the newly selected colour. The whole thing carries on until the Q key is hit.

Two points about the routine may be of interest. CHR$224 is defined — in line 90 — as a little arrow, which moves around with the turtle to show where it is. Without it, you could get lost when the pen is up. Secondly, the keys are interrogated via ?215; this is quicker than the Inkey() function, and makes it easy to react repeatedly to keys which are held down continually, as when the turtle is being turned.

The second example — listing 3 — applies turtle graphics to drawing many copies of the same shape, each one being of a different size and angle. It is a good demonstration of the way in which this type of graphics lends itself to rotating and scaling a display without the need for complex mathematical routines, which would probably otherwise have to be developed especially for each application. The program can be adapted to draw a wide range of shapes but, as it is presented here, it draws a complex spiral pattern which creates an attractive shell-like display.

Its heart is ProcPolyg(n,l,a), which draws an n-sided regular polygon, with a corner at the screen centre, of side length l and at angle a. It uses Turtle 1 to do the job, initially positioning it at screen centre, and then steadily Moving and Turning it to complete the drawing of the polygon.

The advantages of a general routine like this is that it can draw a polygon with any number of sides from three up. The more sides it has, the more the shape looks like a circle; in this case, the program draws 20-sided polygons, which are as near as makes no difference for most purposes to a circle.

The main part of the program is the simple For-Next loop at lines 120-150 which steadily adjust the angle at which the polygon is drawn, while at the same time increasing its size by means of the Length=Length+2 instruction in line 140. The effect as the pattern develops on the screen is of a series of circles which grow as they roll around a central point. ■

Listing 2.

```
10 REM** Simple program to demonstrate Turtlegraphics
20 REM** The turtle moves across the screen, and is steered with
30 REM** the right and left arrows
40 REM** The pen can be put up and down, and the colour changed
50 REM** 29 Sep 1982, by D S Peckett
60
70 REM** Set up the arrays needed by Turtlegraphics
80 DIM TRTLX(1),TRTLY(1),TRTLA(1),TRTLCOL(1),TRTLDOWN(1)
90 VDU23,224,255,64,32,16,8,0,0,0:REM** Pointer character
100 P$=CHR$224:REM** This will show where the turtle is
110
120 MODE1
130 *FX 11,0
140 CLS
150 *FX 4,2
160
170 PROCTRTLINIT(1):REM** Set up turtle 1
180 GCOL 3,7:PROCTRTLMESS(1,P$):REM** Point to turtle
190
200 REPEAT
210   GCOL 3,7:PROCTRTLMESS(1,P$):REM** EOR function flashes the pointer
220   PROCTRTLMOVE(1,7):REM** Move forward 7 units
230   GCOL 3,7:PROCTRTLMESS(1,P$):REM** Flash turtle pointer
240   REM** Use "?215" for high-speed read of keyboard
250   IF ?215=249 THEN PROCTRTLTURN(1,5):REM** Go right?
260   IF ?215=153 THEN PROCTRTLTURN(1,-5):REM** Go left?
270   IF ?215=181 THEN PROCTRTLPENUP(1):REM** "U" to lift pen up
280   IF ?215=178 THEN PROCTRTLPENDOWN(1):REM** "D" to put pen down
290   IF ?215=210 THEN PROCHENCOL(1):REM** "C" to change colour
300   UNTIL INKEV$0="Q":REM** Quit?
310
320 *FX 4,0
330 *FX11,50
340 END
350
360
370 REM** Choose a new colour
380 DEF PROCHENCOL(tno)
390 LOCAL tcol$,tcol
400 REPEAT
410   tcol$=GET$:REM** Get a key
420   UNTIL tcol$>="0" AND tcol$<"8":REM** Make sure it's a colour
430 tcol=VAL(tcol$):REM** Convert to a logical colour number
440 PROCTRTLPENCOL(tno,tcol):REM** New colour
450 ENDPROC
```

Listing 3.

```
10 REM** Draw a spiral pattern with BBC Turtlegraphics
20 REM** 26 Sep 1982, by D S Peckett
30
40 REM** Set up the arrays for turtlegraphics
50 DIM TRTLX(1),TRTLY(1),TRTLA(1),TRTLCOL(1),TRTLDOWN(1)
60 MODE4
70 VDU 19,1,2,0,0,0:REM** Green lines on a black background
80
90 REPEAT
100   CLG
110   Length=15:REM** Initial length of each side of the polygon
120   FOR Angle=0 TO 360 STEP 10
130     PROCPOLYG(20,Length,Angle):REM** Draw 20-sided polygons
140     Length=Length+2:REM** Each one will be a little larger
150     NEXT Angle
160   UNTIL GET$="Q":REM** Pause - finish if "Q" is pressed
170
180 END
190
200
210 REM** Procedure to draw an "n"-sided regular polygon, side length "l",
220 REM** with a vertex at screen centre and the first side at angle "a"
230 REM** to the vertical.
240 DEF PROCPOLYG(n,l,a)
250 LOCAL count%,a,n
260 PROCTRTLINIT(1):REM** Initialize turtle 1
270 PROCTRTLTURN(1,a):REM** Turn for the first side
280 a=a+360/n:REM** Turtle must turn this much at each vertex
290 FOR count%=1 TO n
300   PROCTRTLMOVE(1,l):REM** Draw a side
310   PROCTRTLTURN(1,a):REM** Turn for the next side
320   NEXT count%
330 ENDPROC
```

IMPACT SOFTWEAR

From Scotland's Capital comes quality software for the

ZX Spectrum and VIC 20

The Quest (48K–Spectrum only)

(One of the most exciting adventure games currently available). Fight your way into the depths of the complex in your Quest for the Holy Grail. Discover Gold and Precious stones, buy weapons and Magic wares from a trader. Battle with one of the many Monsters. Up to 1500 locations may be searched in the course of a game. Full sound effects and save game facility. – Only £5.00

Starfighter (16K–Spectrum only)

All action, full-colour, graphic machine-code, Space-battle with devastating explosions. On screen scoring and high score kept. The longer you survive the more difficult it becomes. – Only £5.00

Orb (48K–Spectrum ; 16K–VIC 20)

Make your way through the underground labarynth in your search for the dreaded Orb, which you must destroy. Encounter many Monsters, discover Treasure and try to remember your route so that you can get out again. Full sound effects and save game facility. – Only £5.00

Star Trek (16K–Spectrum; 8 K–VIC 20)

Save the Galaxy from the Klingons using your rapid-fire phasers and photon torpedos. Automatic short-range scan, Galaxy map and Star-bases. Full sound effects and 10 levels of difficulty! Only £5.00

Games Pack (Unexpanded VIC 20)

Alien * Road Race *
The Island * Pontoon *
– Only £5.00

Dealers

Attractive Discounts & Exclusive Agencies available in most areas.

Please Supply:
The Quest (£5·00) ☐ Orb (£5·00) ☐
Starfighter (£5·00) ☐ Star Trek (£5·00) ☐
Games Pack (£5·00) ☐

Please state machine type _____

I enclose a Cheque/P.O. for £ _____
Name _____
Address _____
Post Code _____

All prices **include** P&P and VAT

IMPACT SOFTWARE
70, Redford Avenue,
EDINBURGH EH13 0BW
TEL. 031-441-4257

IJK Software

ALL OUR SOFTWARE IS AVAILABLE BEFORE WE ADVERTISE

A FANTASTIC RANGE OF ● LATEST CASSETTES ●

BBC Micro Games

CASSETTE 13 – HYPERDRIVE
A new, very addictive machine code arcade game. Guide your laser tanks around the network of passages destroying the drone Aliens – but beware, evil OTTO lies in wait!
Only £5.95 inc. Model B (or A+32K)

CASSETTE 14 – STRATOBOMBER
Another new highly colourful machine code arcade game. Can you keep the enemy fleet at bay long enough to destroy the nuclear reactor of the rogue Star Ship before it destroys your home planet? Superb Graphics.
Only £6.95 inc. Model B (or A+32K)

SPECIAL XMAS OFFER
Deduct £2.00 from total if you order 3 or more cassettes

FOR MODELS A AND B

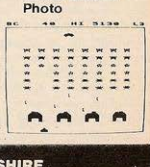
ONE: STAR TREK (8x8 Galaxy, Klingons, Phasers etc.) and CANDY FLOSS, the tremendous new game everyone is talking about!
Only £5.95 inc.
TWO: HANGMAN, KRYPTOGRAM, DICE, BEETLE, GRAND NATIONAL and MUSIC.
Only £3.95 inc.
THREE: MUTANT INVADERS (arcade game). Can you destroy the Mutants before they destroy you with their radioactivity. BREAKOUT (arcade game). Superb version, 6 skill levels, 1 or 2 players.
Only £5.95 inc.
EIGHT: Model A invaders. A superb full feature machine code teletext colour graphics version of the popular arcade game.
Only £4.95 inc.

FOR MODEL B ONLY (A+32K)

FOUR: BEEP-BEEB. Excellent version of the popular 'Simon' game. Very much enjoyed by children, great fun at parties! Includes the choice of the number of colours and sounds.
Only £3.95 For model B (or A+32K)
FIVE: BEEBMUNCH (arcade game). Our version of the 'Pacman' game. Tremendous version containing multi-ghosts, tempting fruits, superpoints, screams etc.
Only £5.95 inc.

SIX: SUPER HANGMAN. The special feature is the high-resolution animated man. Marvel at the detail of his clothing and witness his impatience! Contains many categories.
Only £3.95 inc.
SEVEN: 3D MAZE. Battle against the clock to escape from the maze, with the computer showing your view in 3-D each step you take!
Only £3.95 inc.
NINE: Contains Model B invaders. A superb full feature adaptation of the arcade 'Space Invaders' game. Play normal game of choose from the many options.
Only £6.96 inc.
TEN: Wordpro. Cassette based word processor for Epson or Seikosha printers. Features right hand justification, alter, delete, insert etc., etc. Complete with manual.
Only £9.95 inc.
ELEVEN: ATLANTIS. The superb fast action underwater arcade game. This game features all the usual Atlantis/Scramble features – guide your submarine Nautilus along the undersea landscape to reach your ultimate goal – Atlantis.
Only £6.95 inc.
TWELVE: FLAGS. This model B (or A+32K) program uses hires colour graphics to display world flags and tests your geography at the same time! Have fun while learning.
Only £3.95 inc.

CASETTE NINE Actual Screen Photo



IJK Software 55 FITZROY ROAD, BISPHAM, BLACKPOOL, LANCASHIRE.

Atomic-powered word processing could make all those Christmas thank-you letters less of a chore. Geoff Byrns shows you how.

ATOM

A WORD PROCESSOR is ideal for writing reports, newsletters, circulars and personal letters, or for preparing any text where you may wish to make copies or alter slightly before printing. Written mostly in Basic, Scribe allows just such flexibility. Text can be stored to and loaded from tape and a brief rundown of its features will illustrate what Scribe has to offer.

The word processor program has the facility to insert from one to 64 characters of text; to erase single characters or any size block of text; to allow text to be dumped onto tape; and to load text from tape. It can also carry out character or block movement of text, and replace text.

Control codes for the printer are embedded within the text and new lines, tab, and double width characters can all be generated under software control. You can also view text — even though text is echoed to the screen whilst typing it may be desirable to review the text periodically.

Choose your width

The printed line width may be chosen by the user. It is set at 64 and all printing is controlled to disallow broken words at the end of a line.

The program occupies most of the lower text space, including an 800-byte buffer for memory transfers and a scratchpad, but this can be reduced considerably by fully abbreviating the Basic keywords and using multiple-line statements where possible.

Like any piece of software the more you know about it, the more you can get out of it and it becomes possible to alter the program to suit your own purpose. The best way to get to know Scribe is to use it — but first a complete review of its commands is in order.

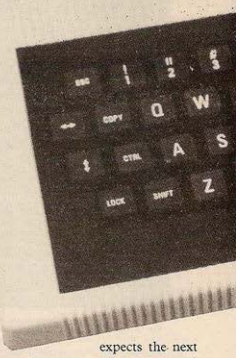
On running, the program sits and waits with a blank screen for you to type. This could be described as the typing mode, as opposed to the command mode which is described later. in the typing mode all keyboard characters except the Return and Copy keys are accepted as text, which is then copied to the upper text space and echoed to the screen. The upper text space is an ideal repository for text and it allows the equivalent of something like four sides of A4 paper packed with words — enough for most purposes.

Inverse characters are taken to represent upper case, and normal characters represent lower case opposite to the usual practice. In this way, the keyboard is used as one would use a typewriter. Since most mistakes are noticed during typing the normal use of the Delete key is catered for. Incidentally, the Repeat key may also be used with any other key as standard and when any key is pressed, a short blip from the internal speaker is produced which has proved a great aid to typing.

To leave this mode and enter the command mode one merely needs to press the Ctrl key and simultaneously press the Copy key. The Atom responds with a blip and moves the cursor one space forward. At this point, Scribe expects the next key-press to be a command from the following list — an error trap is included for those with shaky fingers should an incorrect key be pressed.

S.....Save text

allows text to be dumped to tape. Once this has been successfully saved the routine returns to the typing mode through the View routine.




```
 0 REM SCRIBE 2.5 ** (C) G.W.BYRNS 1982
 5  DIM H(64),X(64),II(3)
10 A=#6202:B=A:F=0:X=#38E0:O=0
15 W=64 :REM WIDTH CHANGE TO SUIT
20 DIM LL(7):F.I=0TO10:LL(I)=-1:N.
25 F.W=0TO1
30 P=#2800
33 P.#21
35L
40 LL0 JSR#FFE3:STA#80:JSR LL2:LDA#80:CMP#14:BCS LL7
42 JMP LL0:.LL7 RTS
45 LL1 LDX#31:CMP#80:BCS LL3:LDA#30:JSR#FFF4:.LL3 RTS
50 LL2 LDX#8F:.LL4 LDA8#F:STA#81:.LL5 DEC#81:BNE LL5
55 LDA#8002:EOR#4:STA#8002:DEX:BNE LL4:RTS
60 LL6 LDA#8:JSR#FFF4:LDA#32:JSR#FFF4:LDA#6:JSR#FFF4:RTS
100J
105 P.#6:P.#12
110 N.
200 DO: REM ACCEPT TEXT FROM KEYBOARD
203 L1.LL0
205 IF ?#80=127 L1.LL6:A=A-1:?A=#D:G.200
210 ?A=?#80:A?1=#D:A=A+1
215 IF A>#97FC G.t
220 L1.LL1
230 UNTIL ?#8001=191
235 A=A-1:A=#8000:O=O
240 L1.LL0
243 IF ?#80=88 G.r:REM PRINT ROUTINE
245 IF ?#80=75 G.k:REM CONTROL CODE ROUTINE
250 IF ?#80=73 G.i:REM INSERT ROUTINE
255 IF ?#80=86 G.v:REM VIEW ROUTINE
260 IF ?#80=83 G.t:REM SAVE ROUTINE
265 IF ?#80=76 G.w:REM LOAD ROUTINE
270 IF ?#80=69 G.e:REM ERASE ROUTINE
275 IF ?#80=82 G.r:REM REPLACE ROUTINE
280 IF ?#80=77 G.m:REM MOVE ROUTINE
290 IF ?#80>27 P."wrong key ","TRY AGAIN":G.200
299 END
300A=B:M=0:P.#12:P.#21:P.#2
305 P.#32
310 DO
315 IF ?A<16 OR ?A>159 G.c
320 GOS.l:REM FIND LENGTH OF WORD
325 IF M>W P.#13:M=0:O=O+1:IF O>59 GOS.a
330 M=M+L
335 IF M>W P.#13:M=0:M=M+L:O=O+1:IF O>59 GOS.a
350 F.T=0 TO L-1
355 [?A?T-32:P.* " G.370
357 IF A?T<65 A.A?T>32:P.*(A?T):G.370
360 P.*(A?T+#20):REM U-LOWER CASE CONVERSION VICE VERSA
370 N.
375 GOS.s:REM ECHO TO SCREEN
380 A=A+L
390 U.?A=#D
395 P.#13
400 P.#6:P.#3:G.280
5001L=0
510 DO
512 IF ?A>128 G.517
515 L=L+1
517 A=A+1
520 U.?A=32 OR ?A=#D OR ?A>128
530 A=A-L:R.
600sP.*3:P.*6:F.T=0 TO L-1
610 P.*(A?T)
620 N.:P.#21:P.#2:R.
800:IF F=1 AND ?A>161:P.#15:F=0:G.850
805 IF ?A>161:P.#14:F=1
810 IF ?A>162:P.#13:P.#32:M=0:O=O+1
820 IF ?A>163 M=M+8:F.I=0 TO 7:P.#32:N.
850 A=A+1:G.315
900L:L.LL0
905 IF ?#80=68:?A=161
910 IF ?#80=78:?A=162:P.##A:P.*#D
915 IF ?#80=84:?A=163:P."    "
950 A=A+1:?A=#D:G.200
1000:P."":IN."INSERT TEXT FROM"*$J
1010 IN."TEXT TO BE INSERTED"*$H
1015 II(0)=A:II(2)=A:A=B
1020 GOS.f:REM FIND MATCH BETWEEN $J AND TEXT
1025 IF F=0 GOS.b:G.i
1030 A=A+LEN(J):D=LEN(H)
1035 GOS.o
1036 G.1090
1040:DO :REM OPEN TEXT WINDOW TO ALLOW INSERTION
1050 II(3)=II(0)+D
1060 ?II(3)=?II(0)
1070 II(0)=II(0)-1
1080 U. II(0)<A:R.
1090 F.I=0 TO LEN(H)-1
1100 A?I=H?I
1110 N.
1120 A=LEN(H)+II(2):G.v
1500:F=0
1510 DO
1520 IF ?A=?J GOS.w
1530 A=A+1
1540 UNTIL ?A=#D OR II(1)>LEN(J)
1550 A=A-1
1560 IF II(1)>LEN(J):F=1
1570 II(1)=0:R.
1600:II(1)=0
1610 F.I=0 TO LEN J-1
1620 IF ?II<>J?I:I=LEN J:G.1640
1630 II(1)=II(1)+1
1640 N.:R.
1700:P.#12:P.#14
1705 F.I=0 TO A-B-1
```

SCRIBE

L.....Load text

allows text loading from tape. A beep signals successful loading and loaded text is automatically displayed. The text may then be added to or manipulated.

I.....Insert text

Respond to the prompts as they appear and single characters, words or sentences — up to 64 characters long — may be inserted anywhere within the text. Remember that the ASCII code 32 is a space and just as much a valid character as any other — so if you want to insert a word or sentence after another word, treat the space as a normal character.

E.....Erase text

Allows for single characters, words or entire blocks of text to be erased. Again respond to prompts as they appear treating a space as previously outlined.

M.....Move text

allows any amount of text up to 800 characters to be moved from anywhere to anywhere within the text.

R.....Replace text

offers a full global search and replacement facility. The replacement can be longer, shorter or the same length as the target text since the routine contains the necessary logic to cater for all circumstances.

```
1707 IF ?#8001<>255 I=A/P.'''/G.1720
1710 P.#(8?I)
1720 N.
1735 P.#15/G.200
1800P.#12;?#8200=A%256;?#8201=A/256
1810 Z=FOUT""
1812 BPUT Z.#AA;WAIT
1815 E=B-2:PUT Z.(A-E)
1820 F.I=E TO A
1825 BPUT Z.?I;WAIT
1830 N.
1840 G.v
1850P.#12;Z=FIN""
1855 E=B-2:DO U. BGET Z=#AA
1860 I=GET Z
1865 F.H=0 TO I
1866 E?H=BGET Z
1870 N.;P.$?
1880 A=?#8201*256+?#8200
1885 G.v
1900eP.'''/IN."ERASE FROM"$J
1910 II(0)=A;A=B
1920 GOS.f
1925 IF F=0 GOS.b;G.e
1930 A=A+LEN(J)
1940 II(3)=A
1950 P.'/IN."ERASE TO"$J
1960 GOS.f
1970 D=A-II(3)
1980 I=0
1990 DO
1995 ?(II3+I)=A?I
2000 I=I+1
2010 UNTIL II(3)?I=#D
2020 A=II(0)-D
2030 G.v
2100oP."$J" HAS NOT BEEN LOCATED"/;R.
2200oF.I=0 TO LEN(H)-1;REM WRITE IN NEW TEXT
2210 A?I=H?I
2220 N.;A=A+LEN(H);R.
2500oP.#13;F.I=0 TO 4;P.#13;N.;D=0;R.
3000>G=0
3010 P.'/IN."REPLACE THE FOLLOWING"$J
3020 IN."WITH "$H;Z=0
3025 IF H?(LEN H-1)=32 Z=1;H?(LEN H-1)=13
3030 II(0)=A:II(2)=A:A=B
3040 IF LEN(H)>LEN(J) G.4010
3050 IF LEN(H)<LEN(J) G.5010
3060 DO
3070 GOS.f
3080 IF F=0 AND G=0 GOS.b;GOS.d;G.4000
3090 G=1
3095 IF F GOS.h
3097 IF Z F=0;A=II0
4000 UNTIL F=0;A=II(0)
4005 G.v
4010 D=LEN(H)-LEN(J)
4015 DO
4020 GOS.f
4030 IF F=0 A. G=0 GOS.b;GOS.d;G.5000
4035 G=1
4040 IF F GOS.o;GOS.h;II(2)=II(2)+D;II(0)=II(2)
4050 IF Z F=0
5000 UNTIL F=0
5002 A=II2
5005 G.v
5010 DO
5020 GOS.f
5030 IF F=0 A. G=0 GOS.b;G.6020
5035 G=1
5040 D=LEN(J)-LEN(H)
5050 IF F=0 G.6020
5055 GOS.h;II(2)=II(2)-D
5060 I=0
5070 DO
5080 A?I=A?(I+D)
5090 I=I+1
6000 UNTIL A?I=#D
6010 IF Z F=0
6020 UNTIL F=0
6025 A=II(2)
6030 G.v
6100oP.'/IN."MOVE TEXT BEGINNING"$J
6110 P.'/IN."ENDING"$H
6115 II(0)=A/A=B
6120 GOS.f
6125 II(2)=A;$J=$H
6130 GOS.f
6135 E=A+LEN(J)
6140 D=E-II(2)
6145 IF D>800 P."BLOCK TOO LARGE";G.m
6150 F.I=0 TO D
6155 ?II+I=II(2)?I
6160 N.
6165 I=0
6170 DO
6175 ?(II2+I)=E?I
6180 I=I+1
6185 UNTIL II(2)?I=#D
6190 II(0)=II(0)-D;E=II(0)
6195 P.'/IN."PLACE BUFFER AFTER"$J
7000 A=0/GOS.f;A=A+LEN(J)
7005 GOS.o
7010 F.I=0 TO D-1
7015 A?I=X?I
7020 N.;A=E+D;G.v
7100oF.I=0TO100;WAIT/N.;R.
```

The global search and replace is the default condition but you also have the option to operate only on the first target found. This is achieved by appending the replacement word with a] as the final character before Return is pressed. This is an extremely useful and powerful command but under extreme circumstances it may be moving the equivalent of several hundred K of RAM around, so be patient. This command has a great many uses, one of which would be to personalise standard letters, for instance, every occurrence of Mr Smith could easily be replaced by Mr Winterbotham throughout the entire text with one simple command.

Viewing text

Another obvious example is when spelling or typing errors have crept into the text unnoticed; again these can simply and easily be replaced by the R command.

V.....View text

This routine prints the entire contents of text to the screen in paged mode. Printer controls are displayed as graphics characters so it is easy to see where, and how many, codes are embedded in the text. The function can be aborted at any time by pressing the Shift key, whereupon a return to the typing mode is executed. It is unfortunate that the Atom screen is fixed at 32 columns wide, since the ideal would be to have the same width screen as the printer, but in practice I have not found this to be detrimental to the layout of any printed matter.

K.....Printer control codes.

This is really a command with sub-commands. On entering the command mode by pressing the Ctrl and Copy keys, then pressing K steers the user to a routine which expects one of three other keys to be pressed. These are D, N, T.

D toggles on the double-width printing and all characters encountered after this control code are double printed until the next D code turns off the effect.

All these control codes are transparent to the user — that is, they do not appear on the screen or get printed out. But you can see them when you use the V view command. The N code forces a new line in the Printed output and is useful in producing the desired layout.

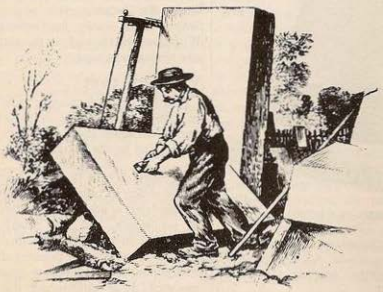
The T code produces a tab of eight spaces. I have implemented a software Tab in this application since different printers have different methods of implementing the same by hardware — so this method should be universal but could easily be substituted to suit your own printer. Any number of the N and T codes may be used to obtain the desired format.

P.....Print text

Once this command has been invoked the text is sent to the printer formatted according to the control codes. The routine also ensures that no broken words are printed at the end of lines and auto-paging of the document is under software control. During printing the text is echoed to the screen.

The program itself is modular in its approach. I trust this can be seen form the Rem statements in the listing, which incidentally should be omitted from the working copy of the Program since some of the coding will thn occupy the buffer space. ■

PRINT OUT



"Life would be so much easier with an Amber 2400 Matrix Printer....."

AMBER 2400
MATRIX PRINTER
LOW RUNNING COST USING
PLAIN PAPER
USED WITH MANY COMPUTERS
INCLUDING BBC,UK101,ATOM
DRAGON,NEWBRAIN,ATARI,
TRS-80,VIC-20 AND MZ-80K

£ 78

+VAT & £2.95 P&P
Or for details send a
large SAE to:

AMBER CONTROLS LIMITED
Central Way
Walworth Industrial Est.
Andover
Hampshire SP10 5AL

MICHAEL ORWIN'S ZX81 CASSETTES

The best software (by various authors) at low prices

QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun."
Your Computer, May '82

"Michael Orwin has built a reputation for value-for-money software and his Cassette 4 offers quantity as well as quality."
Sinclair User, October '82

"If each game was on a separate tape and selling for £5 each I would still recommend them. But all on one for £5 . . .! This sort of value for money just has not been seen before on any personal computer."

"Without sounding pushy I would like to conclude this review by saying — if you have a ZX81 and like games, then you should buy Michael Orwin's Cassette 4."
2 extracts from ZX Computing, Oct/Nov '82

CASSETTE 1

(eleven 1k programs)

machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat.
Basic:
IChing, Mastermind, Robots, Basic Hangman.
PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k.
Cassette 1 costs £3.80

CASSETTE 2

Ten games in Basic for 16k ZX81

Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
Cassette 2 costs £5.

CASSETTE 3

8 programs for 16k ZX81

STARSHIP TROJAN

Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photo torpedo tracking.
PRINCESS OF KRAAL
An adventure game.
BATTLE Strategy game for 1 to 4 players.
KALABRIASZ World's silliest card game, full of pointless complicated rules.
CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.
SECRET MESSAGES This message coding program is very txlp qexi jf.
MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.
Cassette 3 costs £5.

CASSETTE 4

8 games for 16k

ZX-SCRAMBLE (machine code)

Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)

INVADERS (machine code)

FUNGALOIDS (machine code)
GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft.
SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed)
LIFE (machine code)
A ZX81 version of the well known game.
3D TIC-TAC-TOE (Basic)
Played on a 4×4×4 board, this is a game for the brain. It is very hard to beat the computer at it. 7 of the 8 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman).

Cassette 4 costs £5.

Recorded on quality cassettes, sent by first class post, from:
Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL (mail order only please)

ZX-81 LIFE

Life is what you make it, and Peter Whittle certainly puts some zest into the generation game.

COMPLICATED PATTERN manipulation games such as John Conway's Life are ideally suited for programming on to a computer with visual display. Generally speaking, a lot of simple computation has to be performed to generate each new pattern from the previous one. This computation normally takes the form of checking the adjacent positions of each part of the pattern and then applying simple rules in order to generate the new pattern or, in the case of Life, the new generation.

This non-arithmetic computation is very inefficiently performed when written in Basic, involving many slow For-Next loops. With the game of Life on the ZX-81 it typically takes 20 seconds or more per generation. However, this type of computation is ideally suited for a fairly simple machine-code routine.

The display of the ZX-81 can be looked on as an array of 768 squares arranged in a grid 32 across by 24 down. The normal Basic print statements can only use the top 22 lines, the bottom two being used for report codes, although the whole 24 lines are accessible to a machine-code routine. When the total amount of memory exceeds 3.25K a clear screen is padded out with 24 by 32 spaces.

The computer blocks off 793 bytes of the memory to store this display, the extra bytes being Newline characters to mark the end of each line. The character at each position is coded with a number as listed at the back of the ZX-81 handbook. The starting address of this display file is stored at locations 16396 and 16397 and, in general, may move around in the memory — so its position must be checked each time the routine is called.

The game of Life

Briefly, the game of Life is as follows. Imagine a rectangular array of squares — in the case of the ZX-81 display, 24 by 32 in size. A pattern is first of all set up on the array either by a series of suitable print statements or by a more flexible program as suggested below. Certain rules are then repetitively applied to the pattern which will, in general, change the pattern at each step. If a suitable starting pattern is used a very interesting development of shapes can be observed.

The rules to be observed are as follows: first, any square surrounded by less than two, or more than three, occupied neighbouring squares will die of loneliness or overcrowding respectively. Secondly, any square surrounded by three occupied squares will become occupied, that is, live. Third, any square surrounded by two occupied squares remains unchanged. As can be seen, for each position on the array on which the game is to be played, the eight immediately adjacent positions need to be examined to determine whether it lives or dies.

With all the For-Next loops needed to program this in Basic, it could take a very long time to run. However, with the machine-code routine to be described, even in Slow mode where the microprocessor has to share its time between executing the program and generating the display, each generation still takes less than one second.

Loops are performed most efficiently in machine code by setting a count in one of the registers — normally b, c, d or e so that a, or accumulator may be used for arithmetic and the hl pair for register indirect addressing. Each time the program section is to be executed, the count is decremented by one and then checked for zero with the JRZ or JRNZ instructions; do a relative Jump if JRZ is zero or JRNZ is not zero respectively and the loop either repeated or not.

The most efficient register to use is the b register because there is a special instruction DJNZ which decrements b and tests for zero in one. Another instruction type that is used in the program is the bit set and test group.

In the game of Life the whole pattern is scanned and a new pattern is formed according to the rules previously defined. In order to avoid Saving this new pattern in its own part of the memory and then transferring it into the display file, the life/death decision is made and then the square marked in a way that will be invisible to the status-checking routine when it is called for the neighbouring squares. The newly-formed pattern must be kept separate so as not to interfere with the testing of adjacent squares. The square marking is done by setting and testing particular bits of the word, coding each position in the display.

On the ZX-81, O, the character we will use to define the pattern, is coded 34H or 00110100. Counting the bits from the right, starting at 0 we see that bit 2 is a 1. The instruction BIT2 will test this particular bit

(continued on next page)

LOCATION	DECIMAL	LABEL	INSTRUCTION	COMMENT
16514	203,86	CHECK	BIT 2,(hl)	Bit 2 set?
16516	40,1		JRZ 1	
16518	60		INC a	Yes
16519	35		INC hl	
16520	201		RET	
16521	42,12,64		LD hl,(16396)	Display file start
16524	35		INC hl	
16525	14,22		LDc,22	Line count
16527	6,30	CH2	LDb,30	Column number
16529	17,30,0	CH1	LDde,30	
16532	175		X OR a	Reset count
16533	205,130,64		CALL CHECK	
16536	229		PUSH hl	For next position
16537	205,130,64		CALL CHECK	
16540	205,130,64		CALL CHECK	
16543	25		ADD hl,de	For next line
16544	205,130,64		CALL CHECK	
16547	229		PUSH hl	For square being tested
16548	35		INC hl	
16549	205,130,64		CALL CHECK	
16552	25		ADD hl	
16553	205,130,64		CALL CHECK	
16556	205,130,64		CALL CHECK	
16559	205,130,64		CALL CHECK	
16562	225		POP hl	Square being tested
16563	87		LDd,a	d has count
16564	62,3		LDa,3	
16566	186		CP d	d = 3?
16567	40,8		JRZ,LIVE	Jump if yes
16569	61		DEC a	Else
16570	186		CPd	d = 2?
16571	32,8		JRNZ,DEAD	Jump if no
16573	203,86		BIT 2,(hl)	Is bit 2 set also
16575	40,4		JRZ,DEAD	Jump if no
16577	203,198	LIVE	SET 0,(hl)	
16579	24,2		JR,OUT	
16581	203,134	DEAD	RES 0 (hl)	
16583	225	OUT	POP hl	Next position in hl
16584	16,199		DJNZ,CH1	End of row?
16586	35		INC hl	Yes
16587	35		INC hl	
16588	35		INC hl	
16589	13		DEC c	Reset line count
16590	32,191		JRNZ CH2	Last line?
16592	30,52		LD e,52	Yes
16594	42,12,64		LD hl,(16396)	Display file
16597	1,33,0		LD bc,33	
16600	9		ADD hl,bc	Start position
16601	14,22		LD c,22	Line count
16603	6,33	ST2	LDb,32	Row count
16605	35	ST1	INC hl	
16606	203,70		BIT 0,(hl)	Bit 0 set?
16608	32,4		JRNZ,LIFE	Jump if yes
16610	175		X OR a	Zero a
16611	119		LD(hl),a	Kill
16612	24,1		JR,OUT	
16614	115	LIFE	LD(hl),e	New life
16615	16,244	OUT	DJNZ,ST1	End of line?
16617	35		INC hl	Yes
16618	13		Dec c	Line count
16619	32,238		JRNZ,ST2	Last line?
16621	201		RET	Yes

Figure 1.

(continued from previous page)

and set the zero flag — if the bit is a zero — and reset it if the bit is a 1. The zero flag can then be tested by a JRZ or JRNZ instruction. SET and RES will similarly set or reset the particular bit specified.

The only other instructions that may be new to beginners in machine-code programming — although, of course, familiar to regular readers of *Your Computer* — are Push and Pop. These use an area of memory set aside by the computer-operating system for temporary storage. This is called the stack and works on a last-in, first-out principle. Data in the form of 16-bit words is entered or Pushed into the stack or retrieved or Popped from the stack.

The stack pointer, a register we need not worry about here, automatically keeps track of the current top-of-stack position. These instructions are used to temporarily store data out of the way, while the computer gets on with something else. For the readers who missed out, *Your Computer* ran a series on machine code from August to November 1982.

The complete machine-code routine is shown in figure 1. Briefly, its operation is as follows: the whole display is scanned and for each square the bit-checking subroutine, Check, is called for each of the eight surrounding squares, with a count of the number of live ones found and kept in the A register, program location 16525 to 16561.

The count is then checked and bit 0 set or reset accordingly 16563 to 16582. Incidentally, this bit setting and resetting will produce an intermediate pattern of Ps and ■s, that is, the codes 00110101 and 00000001 in the display file. Once the whole array has been processed, it is scanned once more and for each equare, bit 0 is tested to determine its new status and a 0, or 52 substituted for death — a 0 — or life — the letter O — respectively — 16594 to 16621. And that is all there is to it.

The program is loaded into the first Rem statement as suggested by Sinclair, so type out the following; remember to follow the first Rem with 110 spaces, approximately 4 lines.

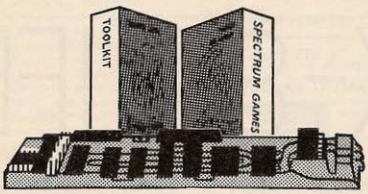
```
 1 REM
10 LET L=16514
20 PRINT L,
30 INPUT I
40 POKE L, I
50 PRINT PEEK L
60 LET L=L+1
70 GO TO 20
```

On running this program it will print out the location. You then type in the decimal numbers as listed in figure 1. Note that some instructions consist of two or more numbers. The screen printout will show that they have been entered properly. When the screen is full type Cont to continue. When you get to 16622 type Stop. The machine-code routine will now be loaded in the Rem statement. All it needs now is a Basic set-up and operating program with some user-friendly embellishments.

```
 1 REM....etc
10 LET L=PEEK 16396+256 * PEEK 16397
20 PRINT "        ""LIFE""
21 PRINT
25 PRINT " MOVE CURSOR WITH
ARROWS "
26 PRINT " PRESS O TO WRITE"
27 PRINT " PRESS P TO START "
28 PRINT " PRESS ANY KEY TO RUN AND
BREAK TO STOP "
29 PRINT " WHEN READY PRESS CONT "
30 STOP
31 CLS
32 LET A=345
40 LET B=A
50 IF INKEY$="5" THEN LET A=A-1
60 IF IN KEY$="6" THEN LET A=A+33
70 IF INKEY$="7" THEN LET A=A-33
80 IF INKEY$="8" THEN LET A=A+1
81 IF A<1 THEN GOTO 32
82 IF A>724 THEN GOTO 32
85 IF PEEK (L+A)=118THEN GOTO 32
87 IF A< >B THEN POKE (L+B), 0
90 POKE (L+A), 146
100 IF INKEY$<> "O" THEN GOTO 130
110 POKE (L+A), 52
120 LET A=A+1
130 IF INKEY$="P" THEN GOTO 140
135 GOTO 35
140 POKE (L+A), 0
141 LET A=1
147 PRINT AT 0, 18; "GENERATION"; A
150 IF INKEY$= " " THEN GOTO 150
160 LET L=USR 16521
165 LET A=A+1
170 GOTO 147
```

■

SPECTRUM BUDGET PAK



SPECTRUM 32K RAM **plus** SPECTRUM TOOLKIT and NEW SPECTRUM GAMES

SAVE £8.45!

For Issue One SPECTRUM – total package price only £44.95
For Issue Two SPECTRUM – total package price only £34.95

JRS SOFTWARE

19 WAYSIDE AVENUE, WORTHING, SUSSEX. BN13 3JU Telephone: (0903) 65691

SPECTRUM

HARDWARE

32K RAM (Issue One Spectrum) ..... Only £42.50
32K RAM (Issue Two Spectrum) ..... Only £32.50

SOFTWARE

Programmers Toolkit (16K & 48K) ..... Only £5.95
Spectrum Games – Airport, Alien, Crabs (16K) ..... Only £4.95

ZX81

A full range of software and hardware are available. Tick the coupon below for your free 1983 catalogue and enclose a large stamped addressed envelope.

I wish to order the following:

☐ Spectrum Budget Pak (For Issue One)	Only £44.95
☐ Spectrum Budget Pak (For Issue Two)	Only £34.95
☐ 32K RAM (For Issue One)	Only £42.50
☐ 32K RAM (For Issue Two)	Only £32.50
☐ Programmers Toolkit (Spectrum)	Only £5.95
☐ Spectrum Games	Only £4.95
☐ 1983 JRS Catalogue	FREE
Tick as applicable — Total (Inc VAT & P&P)	

Name .....
Address .....
..... Age .....

Post to: JRS SOFTWARE, Department
19 Wayside Avenue, Worthing, Sussex BN13 3JU

DOWNSWAY

ELECTRONICS (UK) LTD.

MEMORIES FOR THE ZX81

The Downsway 64K Memory* slots directly on to the computer, without needing an additional power supply, or adding any extra load to the internal 5v regulator. Trade in your old 16K RAM Pack (any make, any age, any condition) for £12.50 against a Downsway 64K Memory to bring the price down to only **£47.45** plus p & p. Without trade-in, it costs just **£59.95** plus p & p — still incredible value!

If you only want 16K of memory for your ZX81, the Downsway 16K RAM Pack offers the same benefits of high quality and low price at only **£24.95** plus p & p.

Both memories measure only 2½ x 1½ x 1in. and are supplied with a foam cushion strip to provide added mechanical stability.

* Reviewed in ZX Computing Aug/Sept 1982 and Popular Computing Weekly 22/7/82.

MORE MEMORY FOR YOUR ZX81 OR SPECTRUM!

NEW! 32K RAM FOR SPECTRUM

A full 48K of memory for the 16K Spectrum — simple D.I.Y. installation by just undoing 5 screws and plugging in!

For Issue One machines (with light grey keys) — a RAM board of advanced design, using "state-of-the-art" technology — only **£42.50** plus p & p.

For Issue Two machines (with dark grey keys) — a simple plug-in kit of I.C.s which fit straight in to the sockets already provided: only **£32.50** plus p & p.

Both come with fully detailed, illustrated instructions.

Naturally Downsway add-on memories are fully tested and guaranteed, but should you be dissatisfied for any reason, just return the memory within 14 days for a full refund (and your old 16K RAM pack, where appropriate).

Please allow up to 28 days for delivery.

DOWNSWAY ELECTRONICS (UK) LTD. DEPT. M, DOWNSWAY HOUSE, EPSOM ROAD, ASHTEAD, SURREY.

Please send me:

Qty.	Item	Price	Total
	32K RAM Board (Issue 1 Spectrum)	£42.50	
	32K RAM Kit (Issue 2 Spectrum)	£32.50	
	64K Memory for ZX81 at trade-in price	£47.45	
	64K at normal price	£59.95	
	16K RAM	£24.95	
	Post & packing		£2.00
	Total		£

My cheque/P.O./Money Order is enclosed

Please debit my Barclaycard No. .....

Name: .....

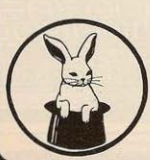
Address: .....

VISA

NEW SPECTRUM SOFTWARE

TRANSYLVANIAN TOWER
In this spine chilling adventure you explore Count Dracula's dark tower from the dismal dungeons to the terrifying top! Discover his 500 room maze with its incredibly spectacular moving three dimensional graphics. Watch out for the swooping vampire bats as you try to rid the world of this Transylvanian terror! Combines an adventure with a maze with a fast moving graphic action game! A new maze everytime! With a full 'save' routine for use during the daylight hours! 48K SPECTRUM only £6.50

JACKPOT FRUIT MACHINE
Featuring holds, nudges and realistic hi.res.symbols. Colourful – just like the real thing!
Plus
SUBMARINE ATTACK
Destroy them before they destroy you. Fantastic fast action fun. Both games just £4.95, 48K SPECTRUM



Richard Shepherd Software

FREEPOST (No stamp required), Maidenhead, Berks SL6 5BY.

Promotion's the name of the game in
'SHIP OF THE LINE' – An adventurous management game. Fearlessly battle your way up the ranks... encounter enemy fleets... survive mutiny, fever and famine... endure fog, fire and thirst... then... when you think you've done well... rush home to Port for promotion! 16K SPECTRUM £4.95 48K SPECTRUM £6.50

MULTI FUNCTION CASH CONTROLLER
Takes care of your Home Budgeting, Bank Account, Standing Orders, Loan and Mortgage Repayments. Complete security ensured by secret password. A budgeting bargain for only £10. 48K SPECTRUM

'SHAKEN BUT NOT STIRRED!'
A James Bond 007 Adventure
Recover a stolen warhead from the lair of Dr Death, but first follow the trail across continents, locate his secret island, encounter the steel fisted giant Paws, then find yourself in his underwater maze and hopefully find the missile... But It Doesn't End There!
Can you resist being 007? Only £6.50 48K SPECTRUM

ORDER FORM Please send me

.....	48K JackpotSub (Attack)	at	£4.95
.....	48K Transylvanian Tower	at	£6.50
.....	16K 'Ship of the Line'	at	£4.95
.....	48K 'Ship of the Line'	at	£6.50
.....	48K 'Shaken but not Stirred'	at	£6.50
.....	48K Multifunction Cash Controller	at	£10.00

OFFER!
Buy 2 get £1 off
Buy 3 get £2 off
Buy 4 get £3 off

By First Class Post
On Quality TDK Cassettes

I enclose my cheque/Postal Order for £ ..... payable to Richard Shepherd

Name .....

Address .....

Machine .... K Memory

```
10 DIM A$(20)
20 POKE 106,PEEK(106)-8
30 GRAPHICS 17:POKE 708,180:POKE 709,124:POKE 710,160:POKE 711,50:POKE 712,4
40 P=PEEK(106):N=P*256
50 FOR M=0 TO 1023:POKE N+M,PEEK(57344+M):NEXT M
60 FOR M=0 TO 103:READ D:POKE N+M+8,D:NEXT M
70 POKE 756,P:A$="$$$$$$$$$$$$$$$$$$$$"
80 FOR M=1 TO 4:POSITION 0,13+M:PRINT #6;A$(1,M+2);CHR$(37);CHR$(38);:NEXT M
90 PRINT #6;CHR$(163);" ";CHR$(39);CHR$(163)
100 POSITION 18,16:PRINT #6;CHR$(163);CHR$(41)
110 POSITION 16,17:PRINT #6;CHR$(39);CHR$(40);A$(1,2);A$;A$;A$;A$
120 PRINT #6;" CHARACTER SET DEMO":POSITION 0,13:PRINT #6;CHR$(163)
130 POSITION 0,0:PRINT #6;CHR$(129);CHR$(130);"        ";CHR$(135);CHR$(137);CHR$(130)
140 POSITION 8,8:PRINT #6;CHR$(135):POSITION 17,10:PRINT #6;CHR$(129);CHR$(130)
150 SOUND 0,50,6,6:SOUND 1,51,4,4
160 POSITION 11,12:PRINT #6;CHR$(10);CHR$(11):POSITION 5,8:PRINT #6;CHR$(10);CHR$(11)
170 FOR D=0 TO 25:NEXT D
180 POSITION 11,12:PRINT #6;CHR$(12);CHR$(13):POSITION 5,8:PRINT #6;CHR$(12);CHR$(13)
190 FOR D=0 TO 25:NEXT D:GOTO 160
200 DATA 0,3,15,31,63,255,255,0,0,192,224,248,252,255,255,0
210 DATA 60,126,255,255,126,24,24,24
220 DATA 255,255,255,255,255,255,255,255
230 DATA 192,224,240,254,255,255,255,255
240 DATA 0,0,0,0,0,0,240,252,0,0,0,0,0,12,126,255
250 DATA 0,0,0,1,63,127,255,255,15,63,127,127,255,255,255,255
260 DATA 1,3,63,202,74,63,31,7,128,192,252,171,170,252,248,224
270 DATA 1,3,63,213,85,63,31,7,128,192,252,83,82,252,248,224
```

ONE OF THE best features of the Atari 400 and 800 computers is the facility to redefine character sets. One can create as many character sets as the imagination can conceive and the computer's memory will hold.

This makes it possible to hold and display instantly any one of a number of character sets, or change the characters at the push of a button. Furthermore, by using Display List Interrupts different character sets can be mixed on the same screen in virtually any way. But perhaps the most interesting thing about a character set is that it takes up just 1K of RAM; imagine, the Latin, Cyrillic and Norse alphabets in 3K, and each one selectable at will.

To create your own character set the first thing to do is decide where in memory to store it. This is because the character set must not be overwritten by a Basic program and must not interfere with an area of memory already used for something else, for example, DOS.

The ideal place is at the top of the available memory. To ensure that it is protected from Basic, first determine the amount of RAM and then subtract from this the amount of memory to be used. Next, the operating system must be fooled into thinking that it only has this reduced RAM capacity available.

Memory location 106 contains the number of pages that are available for use by Basic; a page is 256 bytes long. This location is set by the operating system immediately after switching on the computer and, during a system Reset, this means one is free to alter the value stored there at will. Therefore, placing a smaller number in it can seal off the amount of memory required for use. This is achieved by using the following program.

```
10 GRAPHICS 0
20 POKE 106,PEEK(106)-8
30 P=PEEK(106)
40 N=P*256
```

Line 20 subtracts eight from the number of pages Basic can use. Four of these pages are for use by the new character set; 4*256=1024 or 1K. The other pages are used by the display; if a higher resolution mode than Graphics 0, 1 or 2 is used then more pages will have to be set aside for the display's use.

Line 30 sets P equal to the number of pages Basic can use; N in line 40 is given the number for the start of the new character set.

If we are not going to redefine a complete character set and wish to retain the use of part of the original set then the internal characters in ROM must be transferred to the space reserved in RAM. To do this, enter this program line:

```
50 FOR M=0 TO 1023 : POKE N+M,
   PEEK(57344+M) : NEXT M
```

The original character set resides in ROM at location 57344 onwards. N, as we know, contains the starting address of the new character set.

Before designing the new character set we must understand how a byte can represent a decimal number. Look at the following diagram — bit numbers are shown in the top line, decimal in the bottom line.

7	6	5	4	3	2	1	0	
1	0	0	1	0	1	1	0	= 150
128	64	32	16	8	4	2	1	

As you can see, a byte is made up of eight bits, each bit can contain a 1 or a 0 and, further, each bit is assigned a decimal value as

shown. This means that if a 1 was placed in bit 7 then that byte would have a decimal value of 128. In the example bit numbers 1, 2, 4 and 7 contain 1s. This makes the value of the byte equal to 2+4+16+128=150. Each character is made up of eight bytes and so can be thought of as an eight-by-eight square and, depending on which bits in this square are at 1 and which are at 0 — that is, on or off — we can create a shape. This is illustrated by a grid diagram in figure 1.

The shaded blocks are 1s, the empty blocks are 0s and by using the decimal values of each byte as we did before we find that byte 0 = 36, byte 1 = 24, byte 2 = 60 and so on.

These decimal numbers will be used to create the character on the computer, but first decide which character the new one is to replace. If a little Invader character is to be displayed instead of the dollar sign, look up the character's number using the internal character set table on page 55 of the Atari Basic Reference Manual. The dollar sign is character 4. Since each character is eight bytes long, to find the offset from the start of our character set it is necessary to multiply the character number by eight.

This offset value is then added to the starting address of the character set and the decimal values obtained from the eight-by-eight square are then read into the next eight bytes beginning at that address. These lines of program should make it a little clearer:

```
60 FOR M=0 TO 7 : READ D :
   POKE N+M+(4*8),D : NEXT M
100 DATA 36,24,60,90,90,60,36,0
```

Line 100 holds the decimal values that we are using to create our character; line 60 places these values into our new character set, overwriting the dollar sign character.

The new character has now been placed in memory but it cannot be accessed yet, because the operating system has not been told to use the new character set, so it is continuing to use the original one in ROM. Memory location 756 contains the pointer for the character set and is automatically set to 224 on power-up, system Reset or a Graphics command.

Multiply 224 by 256; this obtains 57344, the location of the ROM character set. Now look back at line 40 of the program and you will find that P*256 gives the location of the character set. So, Poking 756 to P brings the brand-new custom character set into use. Now add the following line to the program or enter it as a direct command after the program has been Run.

```
70 POKE 756,P
```

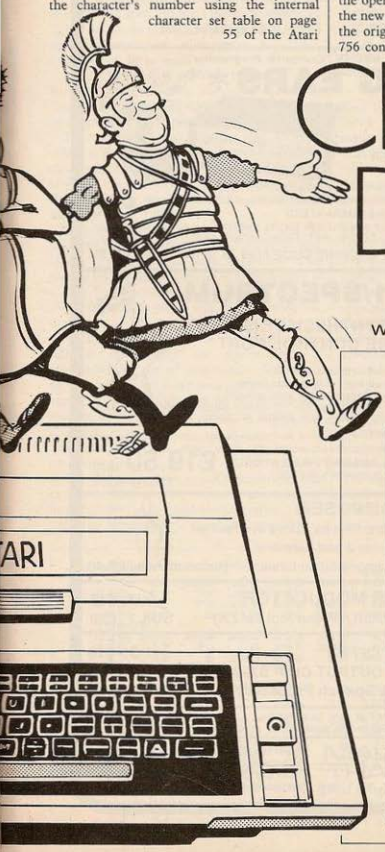
Once the program has been Run, try using the dollar sign; all the other keys work normally. Try the program for Modes 1 and 2, but please note if you redefine lower case or graphics characters in these Modes, remember to add 2 to P. This is the same as using 226 instead of 224 when displaying lower case with the original character set. Try the following lines to change the letter D.

```
65 FOR M=0 TO 7 : READ D :
   POKE N+M+(36*8),D : NEXT M
110 DATA 24,24,24,60,126,255,153,153
```

■

CHARACTER DEFINITION

Space invaders may have more appeal then the Cyrillic alphabet but both are just as easily defined with Keith Robinson's program for the Atari 400/800.



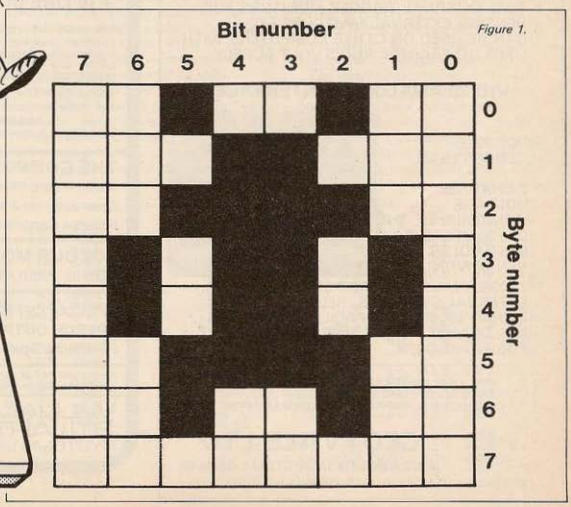
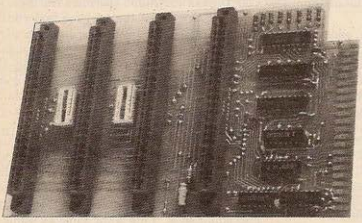


Figure 1.

VIC-20 and PET INTERFACES

VIC-20 EXPANSION SYSTEM

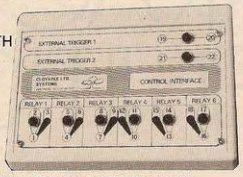


* FOUR EXPANSION SLOTS
* TWO SLOTS WITH BLOCK SELECT FACILITY ALLOWS USE OF STANDARD RAM CARTRIDGES WITHOUT INTERNAL MODIFICATION
* FULLY BUFFERED
* GOLD PLATED EDGE CONNECTORS

PRICE 39.95

CONTROL INTERFACE

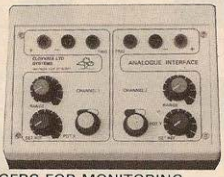
FOR USE ON BOTH VIC-20 AND PET. UNIT CONNECTS TO USER PORT, ALL LEADS SUPPLIED
PRICE 39.95



* SIX RELAYS WITH RELAY ACTIVE LED'S
* RELAYS SINGLE POLE CHANGEOVER TYPE RATED AT 1A 28V DC or 0.5A 50V DC
* TWO EXTERNAL TRIGGER MONITORS FOR SENSING EXTERNAL SWITCHES ETC
* CAN BE USED ON OTHER COMPUTERS WITH USER I/O FACILITY AND 5 VOLT SUPPLY

VIC-20 ANALOGUE INTERFACE

PRICE 39.95
INCLUDES LEAD.



* 2 CHANNEL VOLTAGE MONITORING:
  0 to 30 VOLTS DC
  0 to 2 VOLTS MIN SENSITIVITY
* 2 EXTERNAL TRIGGERS FOR MONITORING EXTERNAL SWITCHES, RELAYS, ETC
* 2 CHANNEL PADDLE FACILITY ALLOWING USE OF UNIT AS PADDLES , X-Y POSITIONING ETC.

ALL PRICES FULLY INCLUSIVE
PLEASE ALLOW UP TO 28 DAYS FOR DELIVERY
CHEQUES/P.O. PAYABLE TO **CLOYVALE LTD.**

CLOYVALE LTD
UNIT 5 POLT 1 INDUSTRIAL ESTATE
0983 854864 VENTNOR ISLE OF WIGHT PO38 1DX

Every computer needs a
CHATTERBOX!
"OK Spock, you win *this* time....

NEW!

SAVE £££s
ONLY **£49**

for
ZX81
SPECTRUM
NASCOM, VIC, PET, BBC, APPLE, TRS80, IBM, CRAY, ETC.
(Please state)

At last! Genuine phonetic synthesis at a sensible price. Gives your computer an *unlimited* vocabulary (nothing more to buy!). Self contained speaker/amplifier, Sinclair connector etc, **PLUS** Expansion socket for BIG EARS **AND** Monitor socket for Music Board. Full instructions, technical notes and programme examples supplied with this outstanding educational unit.

DEALER ENQUIRIES WELCOME

As seen on BBC TV "Computer Programme"

* BIG EARS *

STOP! GO! LEFT! RIGHT!

SPEECH INPUT FOR ANY COMPUTER

Hugely successful Speech Recognition System, complete with microphone, software and full instructions.
BUILT TESTED & GUARANTEED ONLY **£49**
PLEASE STATE COMPUTER: UK101, SPECTRUM, ATOM, NASCOM2, Vic 20, Micron, ZX80/81, PET, TRS80, MZ80K, APPLE II, BBC MICRO
NEW: FAST MACHINE CODE FOR ZX SPECTRUM **£7.40**

ZX81/SPECTRUM

MUSIC SYNTHESISER (STEREO) + 16 LINE CONTROL PORT

Play 3-part music, sound effects, drums etc. Full control of attack, decay and frequency. Input/Output lines provide control and monitor facility for Home Security, Robot Control, Model Railway, etc. etc. Works with or without 16K RAM.

Add keyboard to make a live performance polyphonic synthesiser! Full instructions/software included.
AMAZING VALUE AT ONLY **£19.50** (KIT)
Extra 23 way connectors at £2.60 £25.50 (BUILT)

THE COMPOSER

Music Programme for above synthesiser.
Enter and play 3 part harmony.
Includes demonstration tunes. Recommended **£7.40**

COLOUR MODULATOR **KIT £15**
RGB in, PAL/UHF out (not for ZX) **BUILT £20**

SPECIAL OFFER **I.C. £18**
SPEECH OUTPUT CHIP SX-01
Phoneme Speech Processor **DATA £0.60**

Please add VAT at 15% to all prices.
Barclay/Access orders accepted by telephone

All enquiries S.A.E. please

WILLIAM STUART SYSTEMS Ltd
Dower House, Billericay Road, Herongate, Brentwood, Essex CM13 3SD, England
Telephone: Brentwood (0277) 810244

1K CHESS

Last month David Horne showed you the board. This month he illustrates the move logic.

AS A REMINDER, figure 1 depicts the playing board and figure 2 is the Basic program used to enter the machine code. This month we will start with the main driver. Enter Fast mode and change line 10 to read:

```
10 FOR A = 16681 or 16779
```

Run 10 and start entering the code shown in figure 3. The next routine to enter will be the keyboard controller, after typing Save "4". Change line 10 to read:

```
10 For A = 16860 to 16916
```

Run 10, start entering the code shown in figure 4 and then Save "5". Enter Slow mode and type Run — be prepared for a crash.

The machine is waiting for you to type either a W or B, and will respond by placing the appropriate symbol towards the top right of your screen. Try entering any letter you like first, to ensure that the code rejects all other inputs.

Now enter a number between 1 and 8, followed by a letter A to H at which point just about anything could have happened. The reason for the above exercise is to determine if the keyboard controller is working, that is, selecting which keys will be accepted as inputs.

At this point, it becomes very much more difficult to provide the reader with a comprehensive set of diagnostics. Suffice to say that we are breaking each party down into small routines, which can be re-entered one routine at a time in an effort to isolate the offending error.

Alternatively you may wish to try the program given in figure 7 of last month's article. Assuming after much murmuring, you appear to have this bit correctly entered, our next routine is the address converter. This takes the alphanumeric input and translates it to a board position. Change line 10 to read:

```
10 For A = 16801 to 16859
```

Run 10 and start entering the code shown in figure 5 and Save "6". The address converter has a little routine tacked on to the end which effectively checks to see whether the correct piece is being moved. So now enter Slow mode and Run the program. By the way, it will crash again. Enter your opening colour — B or W — then try spare spaces and the wrong colour positions to ensure that these entries are not acceptable. Now try a correct position, at which point the system will crash.

Finally, the move logic. This is going to be a bit of a marathon. You will be entering 170 numbers, around 15 minutes work. Change line 10 to read:

```
10 FOR A = 16917 to 17087
```

Run 10 and start entering the code shown in figure 6, and finally Save "7". Enter Slow mode, Delete lines 10 to 15, and Save "ZXCHESS", type Run and hope!

To help with error corrections look for the following: if the pawns do not move correctly, then look at the code from 17021 to 17087; problems with any other pieces, look at code 16981 to 17020. There is a piece selector from 16949 to 16980, if just one appears incorrect. The move tables are at 16926 to 16941, with a part of the pawn table at 16778 to 16780.

Now for a brief outline covering the important functions of the machine-code routines presented this month. We started at address 16681 with a call to a subroutine — 16860 — which tests for which key has been pressed, returning with a value in "a" which is compared with B(39) or W(60) to see who should start. Any other response will start the test for key depressed sequence again.

Dependent upon B or W being pressed, a black or white square is placed in the "whose move now" position located by routine DP1. The next routine at address 16701 overwrites the From and To data at the bottom of the board in preparation for the new data entry and is effectively the start of the move routine.

D. Horne. 1983.

Figure 1. The board.

```
 1 REM *** LOTS OF SPACES ***
 9 RAND USR 16570
10 FOR A=16514 TO 17087
11 INPUT B
12 POKE A,B
13 PRINT AT 1,0;A
15 NEXT A
```

Figure 2. Machine-code entry program.

```
                205 220  65 254  39
 40   7 254  60  32 245 175  24
16694
  2  62 128 205 144  65 119  62
  2 205 152  65 119  43 119 205
146  65 119  43 119  35 205 161
 65 254   3  32 234  34  60  64
175  50  62  64  39 205  46  66
16734
205 152  65 205 161  65 254   2
205  48 212  33  62  64  53 126
 60  40 204 133 111 126 185  32
242  42  60  64 126  54   0  18
205 156  64 205 144  65 126 198
16774
126 119  24 179  15  16
```

Figure 3. Main drives.

Continuing, we have a call to subroutine KT, the routine — 16801 — which accepts a number between 1 and 8 followed by a letter between A and H, puts them in the From position and transforms the pair of them to an address on the board by means of the address converter routine — 16806.

The board address is then tested to see whether the contents of the address is either the current mover's piece, an opposition piece, an empty square or part of the backcloth, and, depdenent upon which, "a" is set to a specific number. If it is not one of the current mover's pieces, it returns to the start of the move routine. If it is a current mover's piece, the From position is Saved and the number of legal moves for the position is set to zero.

The piece-move routine — 16942 — is called. This puts all the legal board positions that the From piece can move to into a table. The next data entry is also decoded by subroutine KT. providing a board position, and a status code of that position in "a". The "a" register is interrogated to see if the To

(continued on page 83)

Figure 4. Keyboard controller.

```
                205 187
  2  62 255 189  40 248 186  40
245  68  77 205 189   7 126 201
213  66  75 197 205 220  65 193
185  40   6  12  16 245 209  24
16894
239 209 209 225 213 119  43 201
229  17  29   8 205 238  65 229
 17  38   8 205 238  65 201
```

Figure 5. Address converter.

```
                229 205   6  66 225
126 214  28  71  14  15 175 129
16814
 16 253 198  31  43  70 144 205
140  65  79   9 126 229 254 128
  6   1  48  23 254   0  40  19
  4 254   3  40  14   4 230 128
197 205 144  65  78 185 193  40
16854
  2   6   0 120 225 201
```

Figure 6. Move logic.

```
                                 33
  62  64  52 126 133 111 113 201
   1  15 255 241 242 240  16  14
16934
  17 239  29 227 225  31 243  13
 126 230 127 254  53  40  72  14
   1   6   8  33  38  66 254  51
  40  21  33  30  66 254  48  40
  14  72 254  54  40   9   6   4
16974
 254  55  40   3  33  34  66 123
 134 245 229 197 203 127  32  24
 205 181  65 254   2  48  17 205
  21  66 254   0  40  10 193 225
 121 254   1  40   5 241  24 224
17014
 193 225 241  35  16 217 201 126
 230 128  40   5  33  35  66  24
   3  33 140  65  22   3 123 134
 229 245 203 127  32  24 205 181
  65 254   1  32  24 122 254   1
17054
  32  12 205  21  66 123 254  30
  56  19 254  60  48  15 241 225
  43  21  32 218 201 122 254   1
 196  21  66  24 241 241 225  95
  24 205
```

D. Horne. 1983.

ZX81 & SPECTRUM TOP OF THE PROGS.

SOFTWARE SUPERMARKET

From 100's of programs, we've selected the very best for 16K ZX81 and SPECTRUM. These programs you'll play again and again: they really use your computer fully. Full TOP TWENTY listing FREE with your order. Save £££'s on stamps and mistakes. Our selection service costs you nothing.

PROGRAMS FOR 16K ZX81 AND SPECTRUM

1. WINGED AVENGER "One of the best Sinclair games yet. Covers all the stages of the arcade original" - *PCW*. Very fast 'Phoenix'. shield: smart bombs: great graphics: 7 play levels. 16/48K SPECTRUM. 16K ZX81. (Work Force) £4.50.

2. BLACK CRYSTAL The ultimate role playing adventure. Real-time monster battles. 180K of program for Spectrum, loads in 6 chapters. Over 100K for ZX81, loads in 7 chapters. 48K SPECTRUM. 16K ZX81. (Carnell) £7.50.

3. PIMANIA "An adventure enthusiast's dream" - *CVG*. And you may win the £6,000 Golden Sundial of Pi. Brilliantly written. (Automata) 48K SPECTRUM £10.00 16K ZX81 £8.00.

4. KRAKIT - AND WIN £10,000 TAX-FREE! Solve 12 fascinating clues and you'll find a bank account with a real £10,000 in. Mind-boggling. 16/48K SPECTRUM 16K ZX81. (Artic) £9.95.

5. CHESS "The standard for ZX chess" - *ZX Compg*. 7 play levels, all legal moves, position analysis and recommended move option. Spectrum version has beautiful graphic chessmen. (Artic). 48K SPECTRUM £9.45. 16K ZX81 £9.95.

FOR SPECTRUM ONLY

6. SPECTRES Help Eddie light up his mansion: outwit the ghosts: excellent sound and colour: multi-level: on-screen score: freeze: choice of control keys. 16/48K SPECTRUM (Bug Byte). £8.00.

7. GROUND ATTACK Arcade thrills based on 'Scramble'. "Very absorbing game" - *E&C*. Pilot your spaceship through 26 zones, destroying missiles, fuel dumps, avoiding hostiles. M/C, good sound and colour. 16/48K SPECTRUM (Silversoft). £5.95.

8. ESCAPE "One of the best and most original games for the Spectrum" - *S.U.* 5 very realistic dinosaurs chase you through the maze as you search for the axe to break out. Watch for the pteranodon! Multi-level. 16/48K SPECTRUM. (New Generation). £4.95.

FOR 16K ZX81 ONLY

9. TRADER "Outstanding graphics...animated...original and entertaining" - *S.U.* Travel 6 planets as this 48K game loads in 3 chapters. 25-second test load. Beautiful pictures show off your ZX81. 16K ZX81. (Pixel). £10.50.

10. MAZOGS "Great...a superb new concept" - *PCW*. Such good graphics, you'll really believe you're running through the maze, sword in hand, stabbing mazogs. Harder variations. Very addictive. (Bug-Byte). 16K ZX81. WAS £10. NOW ONLY £8.00.

11. DEFENDER "Another winner!" - *S.U.* Amazing 3D graphics as the alien craft attack your spaceship. A great best-seller. (Greye). 16K ZX81. £4.95.

POST TO: SOFTWARE SUPERMARKET, 87 Howard's Lane, London SW15 6NZ.
Please send me the following.....(qty) programs for my ZX81 16K/SPECTRUM 16K/SPECTRUM 48K. And my FREE listing of your TOP TWENTY programs for my computer.
I ENCLOSE MY CHEQUE/PO FOR £.....(total) made payable to Software Supermarket.

Name .....

Address .....

..... Post code .....

Please complete carefully in block capitals. If we can't read it, you won't get it. Despatch usually 48 hours. For one program only, please add 50p p&p. 2 or more programs p&p free. FOREIGN ADDRESSES PLEASE ADD 50p p&p FOR EACH PROGRAM. Please check carefully that the program you want is available for your particular computer.

PROGRAM NAME	COMPUTER	PRICE
	U.K. Add 50p p&p of order only one program	
	FOREIGN ADDRESSES ADD 50p p&p for each program	
	TOTAL	

SOFTWARE SUPERMARKET
Your one-stop shop for the best Sinclair Programs

(YCS)

ENTER THE SUPER JRS ZX SOFTWARE COMPETITION AND

WIN £250 PLUS

A 14" COLOUR TV

Your original ZX81 or SPECTRUM program could win the first prize of £250 and a 14" colour T.V., the second prize of £150, or one of the three third prizes of a JRS 64K RAM Pack.

PLUS

a substantial cash payment for the distribution rights to your game by JRS (even if you don't win a prize, JRS may still offer to buy your program, providing it meets with the high standards required). All entries must be received by February 28th. Winners will be notified by post by March 31st, and results will be published in the May issues of *Sinclair User* and *Your Computers*.

All programs submitted must be accompanied by an official entry form, available from JRS Software, which contains full details of the rules and conditions of the competition.

Fill in the coupon below and post it today for your official entry form, including a large stamped addressed envelope.

Please rush me by earliest post:
☐ Competition Entry Form ☐ New 1983 Catalogue
* Tick as appropriate

Name .....

Address .....

..... Age .....

JRS SOFTWARE
19 WAYSIDE AVENUE, WORTHING, SUSSEX. BN13 3JU Telephone: (0903) 65691

TRANSFORM LTD.

ZX Business Software.

FOR SMALL BUSINESSES AND THE SELF EMPLOYED

Business Bank Account: this program enables you to make debits under 11 subheadings. Statements include totals of all subheadings. £8.75

Sales Day Book: for all your invoices, this program will enable you to prepare statements of outstanding invoices. Program will also calculate VAT. £8.75

Purchase Day Book: keeps a complete record of all your purchases under 11 subheadings. The program will also calculate and deduct VAT. £8.75

Quarterly Analysis: quarterly totals from Bank Account, Purchase and Sales programs can be analysed with this program. £4.75

All the programs have full search facilities and will enable you to prepare quarterly accounts for your VAT returns and annual accounts for your accountant. These programs can also be used by companies not reg. for VAT.

Business Pack: incl. Bank Account, Sales and Purchase programs. £25

Please specify memory size when ordering for your ZX81 and ZX Spectrum.

All prices include VAT, Post & Packaging. For details send S.A.E. to:

TRANSFORM LTD.,
41 Keats Ho., Porchester Mead, Beckenham, Kent.
Tel: 01-658 1661

(continued from page 81)

board position is empty or has an opposition piece present. If neither of these two is true the code returns to the start of move routines. If true, the board address is compared — 16745.

With each of the legal move positions tabulated by the From routine. Absence of a match restarts the routine again. A match leads on to the move routine — 16759 — which recalls the From position, gets its contents and replaces them with zero, the contents are then put in the 'To' position and routine B/W called. This rewrites all the black vacant squares and finally the "whose move now" square is changed followed by a jump back to the start-of-the-move routine.

The listing provides for a double move for pawns on their initial set-up ranks. The piece moves are controlled by the tables — 16926 — which are called — 16949 — to permit the appropriate movement associated with that piece. See figure 7.

Figure 7.

```
16681 CALL TKP      205 220 65
      CP N          254 39
      JP Z DIS      40  7
      CP N          254 60
      JP NZ DIS     32  245
      XOR A         175
      JP DIS        24  2
      LD A N        62  128
      CALL DPI      205 144 65
      LD (HL) A     119
16701 LD A N        62  8   (Move
                            Routine)
      CALL DP5      205 152 65
      LD (HL) A     119
      DEC HL        43
      LD (HL) A     119
      CALL DP4      205 148 65
      LD (HL) A     119
      DEC HL        43
      LD (HL) A     119
      INC HL        35
      CALL KT       205 161 65
      CP N          254 3
      JP NZ DIS     32  234
      LD (NN) HL    34  60  64
      XOR A         175
      LD (NN) A     50  62  64
      LD E C        89
16731 CALL MOVE     205 46  66
      CALL DP5      205 152 65
      CALL KT       205 161 65
      CP N          254 2
      EX DE HL      235
      JP NC DIS     48  212
      LD HL NN      33  62  64
      DEC (HL)      53
      LD A (HL)     126
      INC A         60
      JP Z DIS      40  204
      ADD L         133
      LD L A        111
      LD A (HL)     126
      CP C          183
      JP NZ DIS     32  242
      LD HL (NN)    42  60  64
      LD A (HL)     126
      LD (HL) N     54  0
      LD (DE) A     18
      CALL B/W      205 156 64
      CALL DPI      205 144 65
      LD A (HL)     126
      ADD N         198 128
      LD (HL) A     119
      JP DIS        24  179
                    15  16
16801 PUSH HL       229     (KT)
      CALL KYBD     205 6   66
      POP HL        225
16806 LD A (HL)     126     (Address
                            Converter)
      SUB N         214 28
      LD B A        71
      LD C N        14  15
      XOR A         175
      ADD A C       129
      DJNZ DIS      16  253
      ADD N         198 31
      DEC HL        43
      LD B (HL)     70
      SUB B         144
16821 CALL DPZ      205 140 65 (Test)
      LD C A        79
      ADD HL BC     9
      LD A (HL)     126
      PUSH H L      229
      CP N          254 128
      LD B N        6   1
      JP Z DIS      40  23
      CP N          254 0
      JP Z DIS      40  19
      NC B          4
      CP N          254 8
      JP Z DIS      40  14
      INC B         4
      AND N         230 128
      PUSH BC       197
      CALL DPI      205 144 65
      LD C (HL)     78
      CP C          185
      POP BC        193
      JP Z DIS      40  2
      LD B N        6   0
      LD A B        120
      POP HL        225
      RET           201
16860 CALL NN       205 187 2  (TKP)
      LD A N        62  255
      CP L          189
      JP Z DIS      40  248
      CP H          188
      JP Z DIS      40  245
      LD B H        68
      LD C L        77
      CALL NN       205 189 7
      LD A (HL)     126
      RET           201
16878 PUSH DE       213
      LD B D        66
      LD C E        75
      PUSH BC       197
      CALL NN       205 220 65
      POP BC        193
      CP C          185
      JP Z DIS      40  6
      INC C         12
      DJNZ DIS      16  245
      POP DE        209
      JP DIS        24  239
16895 POP DE        209
      POP DE        209
      POP HL        225
      PUSH DE       213
      LD (HL) A     119
      DEC HL        43
      RET           201
16902 PUSH HL       229     (KYBD)
      LD DE NN      17  29  8
      CALL NN       205 238 65
      PUSH HL       229
      LD DE NN      17  38  8
      CALL NN       205 238 65
      RET           201
16917 LD HL NN      33  62  64
                            (ADDLIST)
      INC (HL)      52
      LD A (HL)     126
      ADD L         133
      LD L A        111
      LD (HL) C     113
      RET           201
16926 1 15 -1 -15 -14 -16 16 14
16934 17 -17 29 -29 -31 31 -13 13
16942 LD A (HL)     126     (Piece
                            move)
      AND N         230 127
      CP N          254 53
      JP Z DIS      40  72
      LD C N        14  1
      LD B N        6   8
      LD HL NN      33  38  66
      CP N          254 51
      JP Z DIS      40  21
      LD HL NN      33  30  66
      CP N          254 48
      JP Z DIS      40  14
      LD C B        72
      CP N          254 54
      JP Z DIS      40  9
      LD B N        6   4
      CP N          254 55
      JP Z DIS      40  3
      LD HL NN      33  34  66
16981 LD A E        123     (Piece
                            move
                            routine)
      ADD A (HL)    134
      PUSH AF       245
      PUSH HL       229
      PUSH BC       197
      BIT 7A        203 127
      JP NZ DIS     32  24
      CALL NN       205 181 65
      CP N          254 2
      JP NC DIS     48  17
      CALL ADDLIST  205 21  66
      CP N          254 0
      JP Z DIS      40  10
      POP BC        193
      POP HL        225
      LD A C        121
      CP N          254 1
      JP Z DIS      40  5
      POP AF        241
      JR DIS        24  224
      POP BC        193
      POP HL        225
      POP AF        241
      INC HL        35
      DJNZ DIS      16  217
      RET           201
17021 LD A (HL)     126     (Pawn
                            move
                            routine)
      AND N         230 128
      JP Z DIS      40  5
      LD HL NN      33  35  66
      JR DIS        24  3
      LD HL NN      33  140 65
      LD D N        22  3
      LD A E        123
      ADD A (HL)    134
      PUSH HL       229
      PUSH AF       245
      BIT 7 A       203 127
      JP NZ DIS     32  24
      CALL NN       205 181 65
      CP N          254 1
      JP NZ DIS     32  24
      LD A D        122
      CP N          254 1
      JP NZ DIS     32  12
      CALL ADDLST   205 21  66
      LD A E        123
      CP N          254 30
      JP C DIS      56  19
      CP N          254 90
      JP NC DIS     48  15
      POP AF        241
      POP HL        225
      INC HL        43
      DEC D         21
      JP NZ DIS     32  218
      RET           201
      LD A D        122
      CP N          254 1
      CALL NZ ADDLST 196 21  66
      JR DIS        24  241
      POP AF        241
      POP HL        225
      LD E A        95
      JR DIS        24  205
```

D. Horne, 1983.

ZX81 SPECTRUM DRAGON TANDY BBC

16K 16/48 32 LEVEL 2 A/B

ADVENTURE

* Over 200 places to explore in this machine code game using advanced data compression techniques.
* No random elements — you will need skill, cunning and a sense of humour as you explore caves, forest and castles.
* Evade ruthless pursuers and overcome a host of obstacles.
* Multiple word commands and single letter abbreviations.

AWARI

* The ancient African game of logic. It takes 2 minutes to learn the rules but far longer to master the tactics.
* Select the 'Goat-herd' level of play and it's an addictive game for children (8+) that exercises their minds — not their laser fingers.
* Select the 'Witch-doctor' level and it's a threat to your sanity. We haven't beaten it and we wrote it!

£1000 IN PRIZES

FANTASTIC VOYAGE (ZX81 16K ONLY)

This real-time graphics simulation set inside the human body was written by a lecturer in anatomy. You are injected into the blood stream in your miniature submarine. Navigate the arteries, veins and heart to the brain, where a blood clot must be destroyed. Features a real vasular map. You will be attacked by lymphocytes which must be destroyed using arcade game type graphics. Everything you do uses up precious energy. Three display formats — a lateral and frontal body scan plus blood vessel name, a close-up scan and a laser-sight for fighting lymphocytes.

** Buy both Awari and Adventure and enter the 'Foilkade Challenge' competition. Details with cassette or send SAE.

FOILKADE LTD

DEPT. PR9
66 LITTLEDEAN,
YATE,
BRISTOL BS17 4UQ

ALL GAMES £5.95 EACH, 2 FOR £9.95, 3 FOR £13.95 (ANY MIX) INCLUSIVE.

Fed up with Space Invaders? Fed up with moving N.S.E.W. in seemingly endless Adventure games?

—then why not try our exciting range of challenging *war games* for the *SPECTRUM/16K ZX81/DRAGON 32*

1. TYRANT OF ATHENS

Can you survive long enough to turn Athens into the most feared state in the Mediterranean? Train troops, build warships, fight battles by land and sea against hostile Greek States and the vast Persian Empire. Many more features in this very addictive game.

Price: DRAGON £6.95 ZX81 £4.50 SPECTRUM £5.50

2. ROMAN EMPIRE

Your aim is to conquer the hostile countries surrounding Rome. Build armies, appoint Generals and fight campaigns. This challenging game takes full account of morale, fighting efficiencies, leadership ability, etc. 3 levels of play.

Price: ZX81 £4.50 Spectrum £5.50

3. PELOPONNESIAN WAR

Set in Ancient Greece from 431-404 BC, covering the Great War between Athens and Sparta. Your goal is a final victory over the Spartans but you will need all your skill in a combination of diplomacy and military force before you even stand a chance. 3 levels of play.

Price ZX81 only £4.50

4. SAMURAI WARRIORS

How would you have fared as a Samurai in 13th Century Japan? Face challenges from Samurai and bandits. Are you a survivor? Or will you be forced to commit ritual suicide? 7 levels of play, a most fascinating game.

Price: DRAGON £6.95 ZX81 £4.50 Spectrum £5.50

5. WARLORD

A challenging game of analytical skill set in 13th century Japan. You control a village and must meet attacks form other armies, combat challenges from other warlords and their Samurai, attack and defeat pirates, make raids for gold or slaves and feed your village.

Price: ZX81 £4.50 Dragon 32 £6.95

Cheques and PC's please, made payable to: M.C. LOTHLORIEN
4 Granby Road, Cheadle Hulme, Cheadle, Cheshire SK8 6LS

MULTI-COLOUR VIC GRAPHICS

Special effects, user-defined graphics, Martin Howse opens up the Vic colour vista with his illuminating guide to high-resolution graphics.

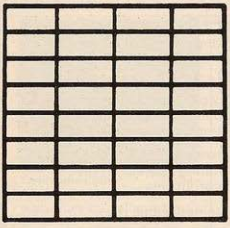


Figure 1.

MULTI-COLOUR GRAPHICS is a form of high-resolution graphics, and that is graphics defined on an eight by eight matrix of dots. However, it is different in that, unlike the high-resolution graphics which only have two colours for a dot on the matrix being lit or not lit, multi-colour characters have four colours.

There are a few limitations, in that the horizontal resolution is halved with multi-colour characters. That means that characters will be made on a four by eight matrix. Also, only four colours can be used; the border colour, the auxiliary colour, the character colour and the screen colour.

You cannot have many different characters with other colours because if you change the border, screen and auxiliary colours for a new character, the old character's colour will change. However, this may be used to produce special effects where many colours are changed very quickly.

To start defining a multi-colour character we must first decide on the colours. Since we can change the screen, border, character and auxiliary colours, we have a choice of four different colours which can be anything in the range of the Vic's first eight colours — except the border and auxiliary colours which may have 16 colours.

These colours are Poked into the Vic in the registers shown in table 1.

The codes of the character colours are found using the following table:—

0 Black
1 White
2 Red
3 Cyan
4 Purple
5 Green
6 Blue
7 Yellow

When the colours have been chosen and Poked into their appropriate memory location, you must start to design the character on a four by eight matrix. See Figure 1.

Once the colours have been put on the matrix where you want them, using, for example, A for auxiliary colour, B for border colour, C for character colour, you can set about coding the image. Each line of the matrix will become a binary number which will be put into memory in decimal. You must go through each of the eight lines of the character matrix to do this.

To convert the line to a binary number you must start at the left-hand side of the line and work your way to the right. If you come to a position where you want a screen colour, write down 00; for a place with a character colour, 10; for a place with a border colour, 01; and for a place with an auxiliary colour, write down 11. You should end up with an eight-digit binary number, for example 00011100. Repeat this for all eight lines on the matrix. When you have finished coding the design, convert all your number to decimal and put them into memory using the following routine:

```
DATA 8 decimal numbers.
FOR F= 7168 to 7175: READ A: POKE F, A: NEXT
```

Now that it is in memory, we have to prevent it from being overwritten. Poke 52,28 is sufficient to do this. To use the character in memory you must change the value of 36869,255 to use the characters. You may have more than 1 character in memory. To do this add more data in the Data statement in the routine and increase the value of F, that is, increase 7175 in the previous routine. Here is an example program going through the steps required to generate a multicolour character.

Poke	Comments
Poke 36879, screen and border colours	See Vic manual for combination of screen and border colours
Poke 36878, code of auxiliary colours (0-15) × 16	
Poke 646, code of character colour (0-7) + 8	Used to change the character colour for a PRINT statement.
Poke 30720 + address of point, code of character colour.	If you are poking onto the screen use this.

Table 1.

First we choose the colours: white, black, red, blue and Poke them into memory.

```
10 POKE 36879,24        put white and black
                        into memory
20 POKE 36878,2 × 16    put red into memory
30 POKE 646,14          put blue into memory
```

Then we design the character, which will be a simple multicolour box, see figure 2. Now convert it to binary.

```
A A A A = 11111111
A C C A = 11101011
A C C A = 11101011
A C C A = 11101011
A C C A = 11101011
A C C A = 11101011
A C C A = 11101011
A A A A = 11111111
```

Then we convert the binary numbers to decimal:

```
11111111 = 255
11101011 = 235
11101011 = 235
11101011 = 235
11101011 = 235
11101011 = 235
11101011 = 235
11101011 = 235
11111111 = 255
```

Then we Poke them into memory.

```
40 DATA 255,235,235,235,235,235,235,255
50 for F= 7168 TO 7175: READ 1: POKE F,A: NEXT
```

Next we must protect the character.

```
60 POKE 52,28
```

And last we must make use of the character and Print it:

```
70 POKE 36869,255: PRINT"(shift clr-home)@"
```

To prevent the screen being messed up by "Ready" appearing in multi-colour lettering the following line may be added:

```
80 GOTO 80
```

When the program is Run a multi-colour box will appear on the screen. You will be able to define your own character as easily as this.

To end with, here is a program to demonstrate what happens when one colour code is changed.

```
10 PRINT "(shift clr-home)"
20 DATA 0,10,10,42,42,130,142,142
30 DATA 0,160,160,168,168,130,142,142
40 DATA 170,170,170,170,170,170,170,160
50 DATA 170,170,170,170,170,170,170,130
70 FOR F = 7168 to 7199
80 READ A
90 POKE F,A
100 NEXT
110 FOR F = 7424 TO 7431: POKE F, PEEK (25600 + F): NEXT
120 POKE 36869,255: POKE 52,28
130 FOR F=1 TO 11
140 POKE 646,INT(RND(TI) × 5) + 10
150 PRINT "@A @A @A @A @A @A @A"
160 PRINT "BC BC BC BC BC BC BC"
170 NEXT
180 POKE 36878,(INT(RND(TI) × 15) + 1) × 16
190 GOTO 180
```

■

Figure 2.

At Last Your Chance To Crack The Machine Code

Trade Enquiries Invited

Also available from most branches of
WHSMITH

ZX81 and SPECTRUM OWNERS

- If you are interested in finding out how a computer REALLY works and want to experience TRUE PROGRAMMING POWER – THE MACHINE CODE TEST TOOL is the answer.
- The MACHINE CODE TEST TOOL is a utility program which comes complete with tutorial course enabling you to enter, test, display and debug hexadecimal machine codes simply and quickly.
- THE MACHINE CODE TEST TOOL is constructed to help the absolute beginner who wishes to explore this fascinating subject, or the expert keen to polish up his machine code programs.
- A HEX: decimal conversion routine is contained within the program as standard.

Post to: OXFORD COMPUTER PUBLISHING, P.O. Box 99, Oxford

Please send me ..... Machine Code Test Tools at £9.95 each

Tick box for edition required ☐ ZX81 ☐ SPECTRUM
Send cheque/postal order to above address

NAME .....

ADDRESS .....

..... POSTCODE ..... **AYC 124**

Allow up to 28 days for postage

ATOM

WAKE UP YOUR ATOM
A New book by Brian Lloyd. 20 great programs to make the most of your Atom, including the old or new colour board if fitted; plus copious programming tips. 128 pages £4.95

THE ATOM MAGIC BOOK
By Mike Lord. A wealth of games and other programs; storing speech in your ATOM, converting programs written in other BASICs, and many more useful software & hardware tips. £5.50

GETTING ACQUAINTED WITH YOUR ACORN ATOM
By Tim Hartnell & Trevor Sharples. 80 programs including draughts. £7.95

PRACTICAL PROGRAMS FOR THE BBC COMPUTER & ACORN ATOM
By David Johnson-Davies £5.95

RAM FOR YOUR ATOM (Or other 1MHz 6502/68XX machine)
16 or 32 Bytes; expand your ATOM to 28 or 38K RAM, ideal for Word Processing, Chess programs & Business software. To fit inside the ATOM or Eurocard rack mounting. Some types run from a single +5V supply. S.a.e. for details.

ATOM ROAM BOARD MZ165 .... £35.00 inclusive
Allows software switching between up to 3 utility ROMs and also 4K RAM fitted so you can load your own 'utility' programs from tape or disc. Simple plugs into sockets on ATOM board.

All prices inclusive of U.K. P & P & VAT where applicable. Overseas customers please add £1.50 surface mail.

TIMEDATA Ltd. Dept A
57 Swallowdale, Basildon, Essex SS16 5JG
Tel: (0268) 411125 (Mon-Fri)

EXPLORING SPECTRUM BASIC
Mike Lord's latest book takes the reader beyond the Sinclair Manual. It contains a wealth of programs and explanations of Spectrum BASIC programming techniques. Topics include writing games programs, personal, business and engineering applications, and utility programs. Worth far more than £4.95

THE EXPLORERS GUIDE TO THE ZX81
Mike Lord's acclaimed book for the ZX81 enthusiast. Includes games, business, engineering and utility programs for both 1K and 16K machines, an introduction to Machine Language, with a list of useful ROM routines, hints & tips, and hardware notes including RAM and I/O circuits. "of the greatest value" (ZX Computing review) £4.95

MASTERING MACHINE CODE ON YOUR ZX81
By Toni Baker; 180 pages of immense value to beginner and expert alike. £7.50

All prices include U.K. P & P – no VAT on books. Overseas customers add £1.50 carriage per order.

TIMEDATA Ltd. Dept A
57 Swallowdale, Basildon, Essex SS16 5JG
Tel: (0268) 411125 (Mon-Fri)

VISA

SPECIAL OFFER! Deduct £1 per cassette when ordering 2 or more.

TOP QUALITY MACHINE-CODE PROGRAMS

FOR THE BBC MICROCOMPUTER

NEW!

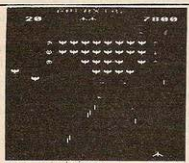
Fruit Machine (32K) £6.50 (Basic & M.C.)

Probably the best fruit machine implementation on the market. This program has it all... HOLD, NUDGE, GAMBLE, moving reels, realistic fruits and sounds.

NEW!

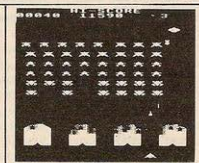
Alien Dropout (32K) £6.50

Arcade-style action continuing the high standards set by our previous programs. Flying aliens which fire at you and explode as the hit the ground.



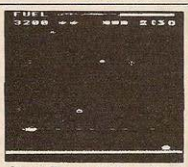
Galaxians (32K) £6.50

Fast action version of the popular arcade game. 4 types of Galaxians (in 3 initial screen formations) swoop down individually or in groups of two or three. 6 skill levels, hi-score rankings, bonus laser bases and increasing difficulty. Superb sound effects and graphics.



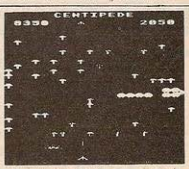
Invaders (32K) £6.50

Superb version of the old classic arcade game with a few extras. 48 marching invaders drop bombs that erode your defences, and 2 types of spaceship fly over releasing large bombs which penetrate through your defences. Increasing difficulty, hi-score superb graphics and sound.



Space Fighter (32K) £6.50

Arcade-style game based upon features from DEFENDER AND SCRAMBLE. 5 types of menacing aliens fire at you and may attempt to ram you. Separate attack phases, fuel dumps, asteroids, repeating laser cannon, smart bombs, hi-score, rankings, 6 skill levels, sound effects.



Centipede (32K) £6.50

Another incredible arcade type game featuring mushrooms, snails, flies, spiders, and centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, and increasing difficulty as the spiders become more active and the number of mushrooms increases.

We pay 25% royalties for high quality programs. *** Dealer enquiries welcome.

SUPERIOR SOFTWARE

TELEPHONE: 0532-842714

Dept. YC3, 69 Leeds Road, Bramhope, Leeds.

Please add 50p per order for P&P.

SPECIAL OFFER FOR CHRISTMAS!

Buy four of these excellent programs for the bargain price of just £19.50.

*SPECTRUM MONITOR
*SPECTRUM EDITOR/ ASSEMBLER
*ZX81 SCREEN KIT 1
*ZX81 ZX-MC *ZX81 REMLOAD

FAST MAIL ORDER-SEND TODAY!

SPECTRUM MONITOR. Machine Code Debug/Disassembler
• Enter, Run, Debug machine code programs. • Compatible with Basic • Breakpoints and Registers Display • Disassembly to screen and/or ZX Printer • 16K and 48K versions on one cassette + 30 page manual. **£7.50**

SPECTRUM EDITOR/ASSEMBLER. A powerful and essential machine code programming aid.
16K & 48K on same cassette with full documentation. Major features include:
EDITOR with Auto Line Numbering; 40 Column screen display; tabulated into fields for easy reading; 5 character Label Names; simple Line Editing and Cursor Control; SAVE/LOAD Text Buffer to cassette; output to ZX PRINTER.
TWO-PASS ASSEMBLER accepts all Z80 mnemonics (plus many unpublished mnemonics) — Decimal or Hex numbers; simple arithmetic on operands; Assembler Directives — ORG, END, DEFB, DEFW, DEFS, DEFL, EQU, DEFM.
WE CANNOT FULLY DESCRIBE THIS IMPORTANT UTILITY HERE. AND ASK YOU TO SEND A S.A.E. FOR COMPLETE DETAILS OF THIS AND ALL OUR PROGRAMS. **£8.50**

ZX81 SCREEN KIT 1. More power to your screen in all your Basic programs.
BORDERS any size, anywhere on screen. SCROLL in all 4 directions. CLEAR and REVERSE PART OF SCREEN. FLASHING CURSOR anywhere on screen — simulates INPUT. DATA FILES SAVE AND LOAD Basic variables: Double Speed. 880 bytes machine code for INSTANT RESPONSE. Becomes part of Basic Program. **£5.70** 4K to 64K

ZX81 ZX-MC. Machine Code Debug/Monitor
• ENTER, RUN, DEBUG machine code programs • SAVE, LOAD, VERIFY at double speed • BREAKPOINTS and REGISTERS DISPLAY • Self contained — cannot be used with Basic • Cassette plus 36 page manual. **£7.50** 4K to 64K

ZX81 REMLOAD. Machine Code Debug/Monitor
• A version of ZX-MC without the Save/Load/Verify facility • Compatible with Basic • CREATE A REM LINE of any length • BREAKPOINTS and REGISTERS DISPLAY • Cassette plus 30 page manual. **£6.95** 16K to 64K

SEND S.A.E. NOW FOR DETAILS
6 Corkscrew Hill, West Wickham, Kent BR4 9BB.

PICTURESQUE PICTURESQUE PICTURESQUE

Prices include VAT & P&P

SPECTRUM 48K ZX81 TRS80 VIDEO GENIE

NOW! for the SPECTRUM FOOTBALL MANAGER IN 3D

COLOUR GRAPHICS

FEATURES INCLUDE.....

★ 4 DIVISIONS ★ F.A. CUP ★ PROMOTION & RELEGATION ★ TRANSFER MARKET ★ TEAM SELECTION ★ SAVE GAME FACILITY ★ LEAGUE TABLE ★ AND MUCH MORE!

ALSO AVAILABLE AT BOOKSTORES & COMPUTER SHOPS INCLUDING BUFFER MICRO SHOP & MICROWARE 3D GRAPHICS ONLY INCLUDED IN SPECTRUM VERSION

HARDWARE REQUIRED

Spectrum 48K RAM	TRS80/ Video Genie
ZX81 16K RAM	LEVEL II 16K RAM

To Order send Cheque/P.O. £7.95 made payable to:—
ADDICTIVE GAMES
at: Dept. Y.C. P.O. Box 278
CONNIBURROW,
MILTON KEYNES MK14 7NE
PLEASE STATE COMPUTER

We're tired of telling you how good our game is..... let our customers tell you

I received F.M. about 10 days ago, and have played about 23 hours so far — addictive is the operative word. —
D. BLAIR, FIFE

I think your game is fabulous since starting with Port Vale in the 4th Division, being promoted, winning the F.A. Cup, and being promoted again to the 2nd Division.—
C. DICKENSON, CANTERBURY

I recently bought your F.M. program and was very pleased indeed. I found it very good value for money and played it all day the day it arrived — I own a ZX81 which is now only used for F.M.—
Yours addicted, M. FRAMPTON, CANVEY ISLAND

I felt that I had to write and congratulate you on your program F.M. I found the game very compelling and exciting, really just like the real thing — keep up the good work and standard.—
N. LAWRENCE, FULHAM

ORIGINALS CAN BE SEEN ON REQUEST

NECESSITY is the MOTHER of Invention

ZXTRA-WID

Philip Barnard will broaden the horizons of your ZX printout.

THE FOLLOWING series of programs has been designed to compile a character set and machine-code routine enabling a ZX-81 to lineprint on a ZX Printer at 42 characters per line in place of the normal 32 characters. Other features include the option to expand to a maximum of 128 different characters — with no inverse, control of character height and width, and a self-edit lineprint at 42 characters per line, all at normal LPrint speed.

For convenience, the routine is compiled and saved in a dimensioned string array, being instantly copied into space automatically reserved above RAMtop whenever it is loaded into the computer. Although it is comprised of 1194 bytes, only some 125 need to be entered via the keyboard for the simplest version. It is left to the user to choose whether or not to expand its capabilities as described later.

The routine itself can be divided into three sections: first, the character set — 1024 bytes; second, LPrint — 118 bytes; third, Edit — 52 bytes.

Each of the 128 available characters is defined by eight 8-bit numbers, thus requiring 1024 bytes for the complete set. In order to print at 42 characters per line it is necessary to reduce character width effectively from 8 to 6 bits including spacing. Bits 7 to 2 are printed whilst bits 1 and 0 are ignored by the printer.

To avoid the tedious entry of a modified Sinclair set, one can use program 1 to do the job. This copies the character-defining codes from ROM and changes them accordingly. In effect, a chosen column of pixels — P — is removed from a character and the remaining columns to the right are shifted left by one column to close the gap created.

The graphics characters are not copied and remain as spaces. However, this gives the user an opportunity to design a new set of symbols to replace them and a character-generating program is suggested for this purpose. Consult page 78 of the ZX-81 manual for keyboard access to these characters, Codes 1 to 10.

I have also included space for a second character set which can be used, for example, to create space for a complete lower case set of alphabet characters as detailed in a later section. These characters replace the ZX-81 inverse Sinclair set and are accessed by the corresponding keyboard entries.

The LPrint section is a modified version of the ROM routine, and is compiled together with the Edit section using program 2. The modifications are as follows: first, point at the address of the new character set; second LPrint bits 7 to 2 only of the characters; third, 42-character lineprint, from a newly-located printer buffer; fourth control of character height and width.

As for the Edit section, Text to be LPrinted is compiled in Basic Rem statements, each one preceded by a call to the routine. The functions carried out are: (1) Locate the start of text via the NxtLine system variable. (2) Set the new printer buffer to an address above RAMtop (32512 to 32554) (3) Examine text in lines of 42 characters to ensure that no words overlap between successive lines. (4) Feed the edited lines to the new printer buffer. (5) Call the LPrint routine. (6) Return to the Basic control program when the end of the Rem statement has been reached.

When operating the compilation programs do remember to start with the command Goto. Do not use Run as this will cause the array holding the routine to be lost and overwritten.

First power-up the computer plus printer, Clear the memory and enter as a direct command Dim A$(1194). Having the dimensioned string array as first entry in the variables store is important because the machine-code program used to copy its contents above RAMtop assumes this to be the case.

Next enter program 1 and operate in Fast mode using Goto 10. The modified character set is completed in about 6.5 minutes. It is necessary to make further small amendments to the letters T, W and Y with the following direct commands:

```
LET A$(458) = CHR$ 124
LET A$(485) = CHR$ 84
LET A$(498) = CHR$ 68
```

Save the program at this and any intermediate stage as your confidence dictates.

Now key in program 2 and delete lines 150 and 160 of program 1. Be careful to enter the program exactly as listed. Operate using Goto 10. The program copies the LPrint routine from ROM, except where a prompt is made for you to enter a modification. Input the value given in the list provided for this section against the number of the array element printed on the TV screen. The LPrint section is complete at A$(1142), so entries made from A$(1143) onwards are for the Edit section. Be careful to double-check these entreis to avoid possible problems later.

Having now compiled the Deep Thought routine, you are in the position to write the short machine-code program used to copy it into memory reserved above RAMtop. It is not necessary to reset RAMtop as the program does this automatically. Enter program 3 and then delete lines 10 to 140 of program 2. Line 1 contains 21 characters, the addresses of which are used to hold the machine code instructions. Operate program 3 by mean of Goto 2 and enter the values as given in the list of entries for this program. When this stage has been completed line 1 should have taken on the appearance of line 1 shown in the listing of program 4. Retaining line 1, replace lines 2 to 6 with the corresponding lines of program 4.

This is the final program in its most elementary form. Save it, together with the array holding the assembled routine, using the command Goto 2. In this way, the machine-code routine in line 1 is executed immediately after the program has Saved. The letters OK should appear on the TV screen, printed by line 5 to indicate that the Deep Thought routine has been located in its new position above RAMtop, now set at address 31232. Print Peek 16389 should return a value of 122. Whenever program 4 is Loaded in future, the process will be repeated. If a message other than OK is printed on the screen check that line 5 is correctly entered. Otherwise re-check your entries for program 2. Two versions of the ZX-81 8K ROM exist, which differ here in the address of one LPrint subroutine. Line 6 can be included to ensure that the program will run on a ZX-81 other than the one used to compile it.

Once the final program is safely recorded on cassette, it can be tested with the aid of program 5, which demonstrates control of both height and width of characters and also 42-character lineprint. Having accomplished its task, you may first New the Basic program 4 before entering the test program. Note that the routine is called from the start of the Edit section — address 32374 — and that addresses 32266 and 32329 control character height and width respectively. The latter are initially set at unity for normal characters.

Text to be LPrinted is set up in Rem statements, any number of which may be employed, provided each one is preceded by a call to the routine. They may also be of any

E TEXT

length within practical limits, Fast mode being recommended for ease of entry. The self-edit facility allows single spacing between all words.

When the test program is Run — there is no need to be restricted to Goto at this stage — you should see line 50 LPrinted in characters of increasing height and width, and line 90 repeated in characters of increasing height only. The number of characters allowed per line is obviously limited by character width — the edit feature only functions for normal characters — so wider-than-normal characters should be sent to the printer as single lines of suitable length. Extending such lines with enough spaces produces a striped effect which softens the tone of printing.

The maximum number of characters per line — N — is given by the expression N=INT(42/X), where X is the width-multiplying factor. I have used this to good effect in test program 6, which shows one way of extending automatic line edit to wider characters, controlled by the Basic program itself. A single character can be expanded to the full paper width — X=42.

For those who wish to extend the character set, the character-generating program can be added to program 4. Characters can be designed on 8 by 8 graph paper grids, remembering that bits 7 to 2 only are printed and that bit 7 is set to zero to act as spacer. Simply convert the eight black and white pixels to 1 and 0 respectively to obtain the corresponding 8-bit binary number. This is entered as such directly into line 70 and then converted into the decimal equivalent in line 110. Note that a zero can be entered as a single "0".

Use Goto 10 in Fast mode when working with this program. It can be terminated after a character has been entered; mistakes can be rectified by entering Goto 20 and beginning the character again.

As stated previously, this method can be used for the unused graphics characters Codes 1 to 10, but a second set of characters can be built up between A$(523) and A$(1024). This could be used for lower-case letters, made equivalent to the respective inverse Sinclair upper-case letters. However, it is more convenient to have them in the position currently occupied by the modified upper-case letters between A$(305 TO 512), and the latter made equivalent to the inverse set, since in typewriter mode they are less frequently used. The true keyboard space must also be used between words for line Edit to function, so it is helpful to avoid overuse of the graphic mode at the keyboard.

Therefore, start by transferring a copy of the upper-case letters, which is quite easy within a string variable such as the one we are using. Just enter as a direct command:

```
LET A$(817 TO 1024)=A$(305 TO 512)
```

Change line 10 of the character generating program to:

```
10 FOR A=38 TO 63
```

You are free to design your own set but to save time I have provided a list of decimal values as an example. Choosing this alternative requires the following further modification to the program to:

```
60 INPUT C (replaces LET C=0)
Delete lines 70 to 120
```

The computer will prompt for the eight entries required for each character as given in the list provided. If you wish to fill up any of the remaining vacant spaces in the inverse set — not already occupied by the upper case set — the value for A in line 10 should lie between 64 and 101, namely 64 less than the Code for the character as shown in the ZX-81 manual. For example, the inverse space, Code 128, becomes Code 64 for the purposes of this program. When writing text for LPrint, upper case letters are then obtained from the keyboard via the corresponding inverse character and lower case letters, numbers and punctuations via the normal characters.

Try producing banner effects by creating characters rotated clockwise through 90 degrees.

Program 1.

```
 10 FOR A=11 TO 63
 20 LET P=4
 30 IF A<10 AND A<>15 OR A=35 O
R A=46 OR A=63 THEN LET P=6
 40 IF A=25 OR A=32 OR A=51 OR
A=54 THEN LET P=8
 50 FOR C=1 TO 8
 60 LET L=PEEK (7679+8*A+C)
 70 LET M=1
 80 IF A<17 OR A=57 OR A=62 THE
N GOTO 140
 90 FOR C=7 TO P STEP -1
100 LET N=INT (L/2**D)
110 LET L=L-M-N*2**D
120 NEXT D
130 LET L=L+M-N*2**P
140 LET A$(8*A+C)=CHR$ L
150 NEXT C
160 NEXT A
```

Program 2.

```
 10 LET B=2172
 20 FOR A=1028 TO 1194
 30 IF A<1034 OR A>1076 AND A<1
119 OR A>1125 THEN GOTO 80
 40 IF B=2214 THEN LET B=2250
 50 LET C=PEEK B
 60 LET B=B+1
 70 GOTO 120
 80 SCROLL
 90 PRINT "A$(";A;")";
100 INPUT C
110 PRINT C
120 LET A$(A)=CHR$ C
130 NEXT A
140 LET A$(1073)=CHR$ 42
```

Entries for program 2.

A$	C	A$	C	A$	C
1025	35	1107	251	1155	0
1026	0	1108	15	1156	127
1027	127	1109	245	1157	0
1028	205	1110	193	1158	0
1029	231	1111	15	1159	43
1030	2	1112	255	1160	237
1031	239	1113	225	1161	160
1032	178	1114	24	1162	192
1033	95	1115	207	1163	40
1034	22	1116	219	1164	22
1035	1	1117	251	1165	15
1077	38	1118	211	1166	249
1078	30	1119	21	1167	18
1079	203	1120	32	1168	175
1080	254	1121	193	1169	0
1081	36	1122	28	1170	42
1082	135	1123	200	1171	190
1083	135	1124	91	1172	40
1084	203	1125	44	1173	19
1085	20	1126	156	1174	43
1086	131	1127	193	1175	27
1087	203	1128	62	1176	16
1088	126	1129	4	1177	248
1089	79	1130	211	1178	1
1090	6	1131	251	1179	42
1091	6	1132	205	1180	0
1092	122	1133	7	1181	9
1093	203	1134	2	1182	24
1094	1	1135	201	1183	4
1095	31	1136	42	1184	35
1096	197	1137	41	1185	62
1097	6	1138	64	1186	118
1098	1	1139	1	1187	18
1099	103	1140	58	1188	229
1100	219	1141	0	1189	205
1101	251	1142	9	1190	1
1102	31	1143	62	1191	126
1103	48	1144	118	1192	205
1104	251	1145	190	1193	24
1105	124	1146	200	1194	211
1106	211	1147	17		

```
ENTRIES FOR LOWER CASE SET

   1  2  3  4  5  6  7  8

38  0  0  112  8  120  72  116  0
39  0  64  54  88  100  100  88  0
40  0  0  56  64  64  64  56  0
41  0  4  4  52  76  76  52  0
42  0  0  56  68  120  64  60  0
43  0  0  28  16  124  16  16  0
44  0  0  56  68  68  68  4  60
45  0  64  64  68  100  68  68  0
46  0  16  0  16  16  16  56  0
47  0  0  8  8  8  8  8  48
48  0  64  72  80  96  80  72  0
49  0  48  16  16  16  16  56  0
50  0  0  124  64  64  64  64  0
51  0  0  68  100  68  68  68  0
52  0  0  56  68  68  68  56  0
53  0  0  68  100  100  68  64  64
54  0  0  52  76  76  52  4  4
55  0  0  68  100  64  64  64  0
56  0  0  56  54  54  54  112  0
57  0  16  16  124  16  20  8  0
58  0  0  68  68  68  68  56  0
59  0  0  68  68  68  68  16  8
60  0  0  84  84  84  84  40  0
61  0  0  68  40  16  40  68  0
62  0  0  68  68  68  68  4  56
63  0  0  124  8  16  32  124  0
```

Program 3.

```
 1 REM 1234567890123456789O1
 2 FOR A=16514 TO 16534
 3 INPUT B
 4 POKE A,B
 5 PRINT A;" ";B
 6 NEXT A
```

Entries for program 3.

16514	33	16521	64	16528	122
16515	64	16522	1	16529	1
16516	64	16523	6	16530	170
16517	64	16524	0	16531	4
16518	122	16525	9	16532	237
16519	1	16526	17	16533	176
16520	16	16527	0	16534	201

Program 4.

```
  1 REM $ RND0?E(RND"." ..) ?"$
GOSUB ▶TRN
  2 SAVE "DEEP THOUGHT"
  3 RAND USR 16514
  4 LET A=32374
  5 PRINT CHR$ (PEEK A+10);CHR$
PEEK (A-88)
  6 POKE 32271,PEEK 2177
```

Program 5.

```
  1 LET M=32265
  2 LET W=32329
 10 FOR A=1 TO 3
 20 POKE M,A
 30 POKE W,A
 40 RAND USR 32374
 50 REM YOUR  COMPUTER
 60 LPRINT
 70 POKE W,1
 80 RAND USR 32374
 90 REM THE TEXT PRINTED FROM T
HIS LINE WILL BE REPEATED WITH O
NE MORE OF INCREASING HEIGHT O
NLY. EDITED AT 42 CHARACTERS PER
 LINE
100 LPRINT
110 NEXT A
```

Program 6.

```
  1 LET A=32374
  2 LET M=32265
  3 LET W=32329
 10 FOR X=3 TO 6 STEP 3
 20 GOSUB 100
 30 IF X=3 THEN RAND USR A
 40 REM THIS IS A TEST RUN OF L
INE EDIT FOR LARGE PRINT
 50 IF X=6 THEN RAND USR A
 60 REM THIS IS A TEST PRINT
 70 RAND USR A
 80 REM ABCDEFGHIJKLMNOPQRSTUVW
XYZ
 90 NEXT X
 95 LET X=1
100 POKE M,X
110 POKE W,X
120 LET N=INT (42/X)
130 POKE 32390,N+1
140 POKE 32401,N
150 POKE 32410,N
160 RETURN
```

Character-generating program entries for lowercase set Diagram.

```
 10 FOR A=1 TO 10
 20 CLS
 30 PRINT "CHARACTER CODE ";A
 40 FOR B=1 TO 8
 50 PRINT B;". ";
 60 LET C=0
 70 INPUT B$
 80 IF B$="0" THEN GOTO 130
 90 IF LEN B$<>8 THEN GOTO 70
100 FOR D=1 TO 8
110 LET C=C+VAL B$(D)*2**(8-D)
120 NEXT D
130 PRINT C
140 LET A$(8*A+B)=CHR$ C
150 NEXT B
160 PRINT "PRESS N/L FOR NEXT C
HA., OR ENTER "S" TO STOP."
170 INPUT C$
180 IF C$<>"S" THEN NEXT A
```

```
     BIT          BINARY      DECIMAL
   76543210
1:.  ■■■■■■■■  =  00000000  =    0
2:.  ■■■■■■■■  =  00100000  =   32
3:.  ■■■■■■■■  =  01010000  =   80
4:.  ■■■■■■■■  =  00100000  =   32
5:.  ■■■■■■■■  =  01010100  =   84
6:.  ■■■■■■■■  =  01001000  =   72
7:.  ■■■■■■■■  =  00110100  =   52
8:.  ■■■■■■■■  =  00000000  =    0

THIS PRINTS AS  ■■■■■■■■■■
```

Access

GEORGE'S

VISA

BOOKSELLERS SINCE 1847

COMPUTER BOOK DEPARTMENT
81 PARK STREET, BRISTOL BS1 5PF

(Telephone: 0272 276602, extension 42 — ask for Jean Young)

A BOOKSHOP ADVERTISING IN A COMPUTER MAGAZINE? NOT SO STRANGE WHEN YOU KNOW OF THE SERVICE WE PROVIDE FOR COMPUTER USERS!

A stock of about 600 computer book titles on all aspects of computers and computing at all levels. We are constantly receiving new stock and most of the books which you see advertised are available from our shelves.
A comprehensive catalogue (price, £2.00 plus 42p. post and packing) containing approximately 3,700 titles, any of which can be ordered. It is hoped to issue an updated version each year.
Software for a variety of computers, including **the BBC's own software.** We should very shortly have the Acornsoft range of books and software.
Computer magazines, a wide range obviously including this one!
The Jupiter Ace and Sinclair ZX81 computers.
The Memotech 16K Memopak.
Much more to follow.

YOU ARE ALWAYS WELCOME IN A BOOKSHOP

ZX SPECTRUM HARDWARE
24 line programmable Input/Output Port

This new port has been designed exclusively for the ZX Spectrum and utilises MOS technology to minimise bus loading. The main features are:

- 3 x 8 bit ports
- Port mapped using IN and OUT commands
- 3 basic modes of operation
- Direct Bit Set/Reset capability
- Outputs capable of sourcing 1mA at 1.5 volts
- Access via 3 x 16 pin DIL sockets **and** 28 way edge connector

The port is available fully built together with a set of detailed instructions and suggested control applications. The port can either be used with our new Motherboard thus allowing a further card to be used, or with a stackable connector. Either way, it means that Micro-Drives, Printers etc. will run happily with the port.

ZX Spectrum PPI Port **£16.50**
ZX 2 Slot Motherboard **£16.95**
ZX Stackable Connector **£5.50**

The prices are inclusive of VAT but postage must be added at 70 pence for a single item (100 pence for 2 or more items).
Please note that we shall continue to support the ZX81 and that we also offer a 16 bit port for the 81 based on a Z80A PIO at £15.50 inc.

ZX81 Klik-Keyboard

This is a full, forty key, moving keyboard which fits into the recess left after peeling off the existing 'touch-sensitive' keypad. Consider the following advantages:

- Positive feedback from keys
- Fits onto the ZX81
- No trailing wires
- No special case needed
- Elegant design with two colour legends

The fully built keyboard requires *absolutely no soldering* since two flexible connectors plug into the ZX81 sockets. Alternatively, the keyboard is available as an easy to build kit at a considerable saving. Other ZX81 products available include a two-tone keyboard bleeper (fits inside the case) at £8.95 built, and a Repeat key kit at £3.95. Now available with 41 keys, the extra key can be used to give a repeat or reset facility £26.50 (built) £23.00 (kit).

Your Name and Address _____

Quantity	Description	Unit Price	Date / Amount	
	ZX81 Keyboard Kit	£22.50		
	ZX81 Keyboard Assemnled	£28.00		
	ZX81 User I/O Port	£15.50		
	ZX Spectrum PPI Port	£16.50		
	ZX 2 Slot Motherboard	£16.95		
	ZX Stackable Connector	£5.50		
		Sub total		
		Carriage		70
		Total due		

Cheques/P.O. made payable to:
KEMPSTON ELECTRONICS
Please allow 21 days for delivery

YC10

KEMPSTON ELECTRONICS
60 Adamson Court, Hillgrounds Road, Kempston, Beds MK42 8QZ

BASIC DICTIONARY

This dictionary, compiled by Tony Edwards, will explain the function of common Basic words as used in popular machines, enabling you to work out your own machine's equivalent. A useful complement to our recent series on Basic dialect translation.

IF. . .GOSUB A multiple branching statement which will jump to the named subroutine if the conditions following the IF are met.

IF. . .GOT Used in PDP-8E Basic as an abbreviation for IF. . .GOTO.

IF. . .GOTO A multiple branching statement which will jump to the line named if the conditions following the IF are met.

IF. . .LET A statement which assigns a value to a named variable if the conditions following the IF are met.

IF. . .T Used in TRS-80 Level 1 Basic as an abbreviation for IF . . . THEN.

IF. . .THE Used in PDP-8E Basic as an abbreviation for IF. . .THEN.

IF. . .THEN A conditional statement which is implemented only if the conditions following the IF are met. The statement following the THEN can be an assignment statement, or the address of a jump. Some computers allow operating statements such as END to follow the THEN, such as IF X = 0 THEN END. An ANSI standard statement.

IF. . .THEN. . .ELSE Some compilers allow one or more ELSE to follow the THEN statement. The statement following the ELSE will be processed only if the conditions following the IF are not met. This can be simulated by the use of nested IF. . .THEN statements — see *Your Computer* June 1982, page 44.

IN. Used in TRS-80 Level 1 and Palo Alto Tiny Basic as an abbreviation for INPUT.

IN# The command used by Apple II Basic to instruct the computer to address the peripheral designated by the argument.

**INKEY$** Used by TRS-80 Level II to input a character direct from the keyboard without the use of Enter. The program does not halt to await a key stroke and if no key is depressed, it returns an empty string — ASCII code 0. If the program is to be halted to await the key entry the INKEY$ must be embedded in a waiting loop. Similar to the GET statement.

INP This statement reads a decimal value from a port specified by the argument. An identical statement is used in PDP-8 Basic as an abbreviation for INPUT.

INPUT A universally-used statement which causes the computer to halt and await keyboard input usually outputting a ? prompt. The program will not continue until the Enter or Newline key is used. An ANSI standard statement.

INPUTL A statement similar to INPUT, but the carriage return is supressed.

INPUTLINE A BBC Basic statement, similar to INPUT, which uses a new line for each item input. The item is taken and assigned as is including commas, quotes and leading spaces.

INPUT # A BBC Basic statement which reads data in internal format from a file and assigns it to the variables specified as the argument.

INPUT # -x A statement which inputs a data unit from the port numbered x.

INSTR A function which returns the position of a sub-string within a string. If the substring is not found a 0 is returned, for example: X = INSTR (A$,B$) will return 2 if A$ = "T.EDWARDS" and B$ = "EDWARDS".

INT This function is used to round off numbers to their integer value. Numbers are always rounded down. Note that INT (−8.1) returns −9. *See also CINT.* A standard ANSI statement.

INVERSE This is an Apple II function which causes any text printed under it to be displayed as black letters on a white block.

L

L. Used as an abbreviation for the LIST command in a number of computers including Acorn, TRS-80 level 1, and Palo Alto Tiny Basic.

LE An alternative sometimes encountered for "less than or equal to".

LEFT A function used, sometimes with a $ appended, to isolate a specific number of characters starting at the left up to the number used for the second argument. The first argument being the string to be used. *See also RIGHT $ and MID $.*

LEN A function which will return the length of the string indicated as its argument.

LET The ANSI standard word to assign a value to a variable. For instance LET A = 10 would assign the value 10 to the variable named A. Some computers such as the ZX-81 require it, but in most cases it is optional. Some programmers use it optionally to flag the first use of a new variable.

LGT A function which calculates the common logarithm of its argument. The argument must be greater than 0. A common logarithm to the base 10.

LI Used as an abbreviation for LIST on TI-99/4 and other computers.

LIN A statement which causes a printer to skip the number of lines specified in the argument before printing the next line.

LIS The PDP-8E abbreviation for LIST.

LIST A command, also used as a statement, which causes each line of a resident programme to be printed in turn. Optional arguments cause only specific line numbers to be printed.

LLIST A command, or statement, used in some machines which operates like the LIST command but outputs to a printer.

LN A function which calculates the value of the natural logarithm of its argument. The argument must be greater than 0. A natural logarithm is the logarithm to the base e.

LOAD A command, which can be used as a statement, to cause a program to be loaded into memory from a storage medium.

LOG The ANSI standard word for the function to calculate the natural logarithm of its argument. An alternative to LN.

LOGE Another alternative to LN.

LOG 10 An alternative word with the same meaning as LGT.

LPPRINT A command and statement similar to PRINT — *see PRINT* — which causes the printout to appear on the printer.

LT An alternative used on some computers for "less than".

M

M. Used as an abbreviation for the MEM function in Microsoft Basic level 1. It can be a command function or statement.

MAN An unusual command from the Apple II set which allows manual insertion of program line numbers. Not used in programs.

MAT A prefix to a statement to indicate that a matrix is to be operated on by the next statement. For example, MAT INPUT will cause the processor to pause awaiting the inputting of a complete matrix. The matrix dimensions will have been previously assigned with a DIM statement. Other matrix statements are MAT PRINT and MAT READ.

MEM A command or statement which returns the number of bytes of memory remaining unused when it is called. An equivalent command to FREE (0).

MID $ A function which isolates a substring from within a previously defined string. The first argument is the target string or string name, the second argument is the start position, and the third argument the length of the substring. For example MID $("PRINT", 3, 2) would return "IN". Some compilers do not have the final $ character in the function. ■

DISASSEMBLIN SPECTRUM RO

FOR PRACTICAL purposes, decoding the ZX-81 ROM gives the average user a list of symbols and numerals which provide a level of understanding little different from the original mass of numerical output. The resultant listings from the disassembler published in July's *Your Computer* unlock the power of the ROM, enabling machine-code programmers to use sections of code within their own programs. This should help you a little further along.

The value of a disassembler is significant only if you can use segments of the code within your own programs.

A further breakdown of the ROM routines is required to discover where each machine-code block begins. I have continued the theme of producing Basic equivalents to the machine code to preserve a degree of familiarity for those whose machine-code experience is limited.

From Address 3113 to 3143 is a list of pointers — table 1. Address 3113 is taken as the starting point and the contents of the address are added to the address to provide a pointer to another address. Figure 4 demonstrates this function provided by the Basic program in figure 3.

The result is an address which further points to the class of command being considered and the address of the machine code for that command in ROM. The commands start at code 225 — LPrint, which is defined in ROM as command 0 up to code 255 (copy), which is defined in ROM as command 30. Therefore if we follow LPrint through, we see that it is defined as command 0 and points to address 3113 + 139 = 3252.

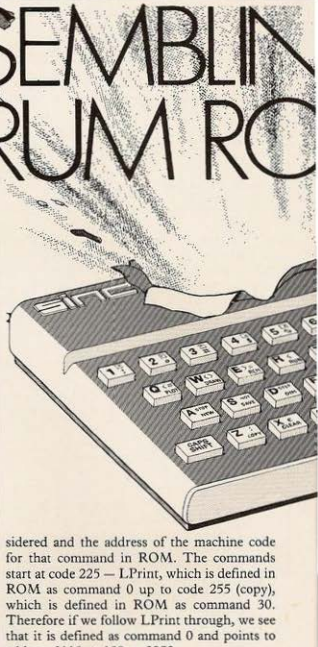


Table 1.

[illegible]	139	3113	ADC	A	E
[illegible]	141	3114	ADC	A	L
H	45	3115	DEC	L	-
[illegible]	127	3116	LD	A	A
[illegible]	129	3117	ADD	A	C
?	3	3118	LD	B	C
?	117	3119	LD	[illegible]	L
?	25	3120	LD	B	A
RND	64	3121	LD	B	B
PI	66	3122	LD	B	D
F	43	3123	DEC	HL	-
*	82	3124	RRA		
3	31	3125	RRA		
B	55	3126	SCF		
?	82	3127	LD	D	D
?	69	3128	LD	B	L
?	15	3129	RRCA		
?	109	3130	LD	L	L
F	43	3131	DEC	HL	-
?	88	3132	LD	E	H
H	45	3133	DEC	L	-
?	90	3134	LD	E	D
V	59	3135	DEC	SP	-
?	76	3136	LD	D	H
?	69	3137	LD	B	L
B	13	3138	DEC	C	-
?	82	3139	LD	D	D
?	90	3140	LD	E	D
?	77	3141	LD	C	L
+	21	3142	DEC	D	-
?	106	3143	LD	L	D
"	1	3144	LD	BC	532
"	20	3145			
"	5	3146			

Table 2.

A	33	3550	DIA		
?	57	3551	DEC	H	-
?	83	3552	LD	D	E
?	15	3553	RRCA		
?	107	3554	LD	L	E
/	19	3555	INC	DE	-
?	118	3556	HALT		

Figure 3.

```
PSN IN                DISPLACEMENT        TABLE
TABLE   ADDRESS                           ADDRESS

  0       3113          139               3252
  1       3114          141               3255
  2       3115           45               3160
  3       3116          127               3243
  4       3117          129               3246
  5       3118           73               3191
  6       3119          117               3236
  7       3120           95               3215
  8       3121           64               3185
  9       3122           66               3188
 10       3123           43               3155
 11       3124           23               3147
 12       3125           31               3156
 13       3126           55               3181
 14       3127           82               3209
 15       3128           69               3197
 16       3129           15               3144
 17       3130          109               3239
 18       3131           43               3155
 19       3132           58               3200
 20       3133           45               3176
 21       3134           90               3224
 22       3135           59               3194
 23       3136           76               3212
 24       3137           69               3205
 25       3138           13               3151
 26       3139           82               3221
 27       3140           90               3230
 28       3141           77               3215
 29       3142           21               3163
```

Figure 4.

```
PSN IN                DISPLACEMENT        TABLE
TABLE   ADDRESS                           ADDRESS

  0       3113          139               3252
  1       3114          141               3255
  2       3115           45               3160
  3       3116          127               3243
  4       3117          129               3246
  5       3118           73               3191
  6       3119          117               3236
  7       3120           95               3215
  8       3121           64               3185
  9       3122           66               3188
 10       3123           43               3155
 11       3124           23               3147
 12       3125           31               3156
 13       3126           55               3181
 14       3127           82               3209
 15       3128           69               3197
 16       3129           15               3144
 17       3130          109               3239
 18       3131           43               3155
 19       3132           58               3200
 20       3133           45               3176
 21       3134           90               3224
 22       3135           59               3194
 23       3136           76               3212
 24       3137           69               3205
 25       3138           13               3151
 26       3139           82               3221
 27       3140           90               3230
 28       3141           77               3215
 29       3142           21               3163
```

Figure 1.

```
"      5  3147  LD   B  0
"    129  3148
"     14  3149  ADD  A  C
"     14  3150  LD   C  6
"      0  3151
" THEN 222  3152  SBC  A  5
"      5  3153
"    171  3154  XOR  L
"     13  3155  DEC  C
"      6  3156  LD   B  0
"      0  3157
"    181  3158  OR   L
"     14  3159  LD   C  0
"      0  3160
>=   220  3161  CALL C  12
<    12  3162
"      0  3163
**   116  3164  RET  C
"     4  3165  LD   C  4
"     4  3166
"    20  3167  INC  D
"     6  3168  LD   B  223
" TO  223  3169
"     5  3170  LD   B  5
"     5  3171
"   185  3172  CP   C
"    13  3173  DEC  C
"     4  3174  INC  B
"     0  3175  NOP
I     46  3176  LD   L  14
"     14  3177
"      5  3178  DEC  B
" INT  207  3179  RST  8
"     10  3180  LD   A  [illegible]
"         3181  LD   BC 59648
"         3182
" DIM  233  3183
"     14  3184  LD   C  5
"         3185
"      9  3186  ADD  HL BC
"     20  3187  DEC  D
"         3188  DEC  B
"    195  3189  LD   L  D
"     13  3190  DEC  C
"      0  3191  NOP
?    195  3192  JP   771
"     5  3193
"         3194
"    175  3195  XOR  A
"     14  3196  LD   C  3
"         3197  RET
"     46  3198  JR   NC 7
"         3199
"      6  3200  LD   B  26
"     26  3201
"      5  3202  LD   B  0
```

```
"      0  3203
"    146  3204  SUB  D
"      3  3205  LD   C  3
"      3  3206
?    106  3207  LD   L  H
"     14  3208
"         3209
RND   64  3210  LD   B  B
"         3211  INC  BC
"         3212  DEC  B
" PLOT  246  3213  OR   2
"      8  3214
"      0  3215  NOP
?    124  3216  LD   A  H
"     14  3217  LD   C  0
"      0  3218
"    184  3219  SBC  A  D
"     20  3220  INC  D
"      0  3221  NOP
"     48  3222  LD   HL (1546)
"     16  3223
"         3224
"     56  3225  LD   A  [illegible]
"      6  3226  LD   B  0
"      5  3227
"    175  3228  XOR  A
"     11  3229  DEC  BC
"         3230  LD   B  26
"     26  3231
"      6  3232  LD   B  0
"      0  3233
"    175  3234  XOR  A
"     11  3235  DEC  BC
"      0  3236  NOP
"     14  3237  LD   C  12
"     12  3238
"      6  3239  LD   B  0
"      0  3240
M     50  3241  LD   (15) A
?     15  3242
"      0  3243
F     43  3244  DEC  HL
?     15  3245  RRCA
"     48  3246  JR   [illegible]
?     35  3247  INC  HL
"     15  3248  RRCA
"      0  3249  NOP
?    105  3250  LD   L  C
"         3251  EX   AF AF
"         3252  DEC  B
NC5   203  3253  [illegible]
"     16  3254
"      3  3255  INC  BC
"     44  3256  INC  L
"      7  3257  RLCA
CLEAR 253  3258  [illegible]
```

G THE M

Okay, so you can decode your ROM. But where does it get you? In this article, David Horne looks at practical applications.

Figure 1 shows the contents; address 3252 and that which follows. The first address contents give the class of command; these are found in table 2 which commences with class 0 at address 3350. The class determines the attributes of the commands and also whether there should be a separator or not:

POKE A, B

A and B are attributes, the comma is the separator.

If the class is 0 or 5, then the next address contains the address of the routine in ROM. Otherwise further attributes or separators follow, until a class 0 or 5 is reached.

Figure 1 gives an initial breakdown of the first three parts of ROM command tables. You can decode the remainder if you wish; the same technique is used to unravel the class tables.

Where does this lead us? You can call the Basic class 0 commands from within your own machine-code programs.

201 105 8 Call 2153

will copy the screen to printer,

Call 3883 will set slow mode

Call 3875 will set fast mode

there are others; what can you do with them?

Figure 5 gives the Basic program for decoding this particular table and figure 6 the unravelled response.

As I said, the Basic programs are simplifications and really only pick out the essentials of the machine code. Figure 2 gives the ROM table decoder; if you followed the series on machine code, neglecting the RS32 and RS24, it should start to make sense.

The Spectrum tables are decoded in a similar manner, but in order not to fill the magazine with machine-code listings of the ROM, I have just presented the final decoded tables, figures 7 and 9, and the Basic programs for decoding the Spectrum ROM tables, figures 8 and 10. ■

Figure 2.

```
 TO      820  3295  RS24
 *       [illegible]  LD   B   0
         0    3296
 RETURN
         254  3297  CP   118
 ?       118  3298
 COS     200  3299  RET   Z
 ?       [illegible]  LD   D   H
 SCROLL
         231  3301  RS32
 ?       121  3305  LD   A   C
 CHR$    [illegible]  SUB  225
 LPRINT
         225  3304
 G       [illegible]  JR   C   59
 H       [illegible]  LD   C   A
 I       [illegible]  LD   HL  3113
 J       [illegible]
 K       [illegible]  LD   C   [illegible]
 L       [illegible]  ADD  HL  BC
 M       [illegible]  LD   C   [illegible]
 N       [illegible]  ADD  HL  BC
 O       [illegible]  JR   3
 P       [illegible]  LD   HL  (16432)
 Q       42   3316
 R       48   3317
 RND     64   3318
 ?       186  3319  LD   A   [illegible]
 ?       35   3320  INC  HL
 S       34   3321  LD   (16432) HL
 T       48   3322
 RND     64   3323
 ?       [illegible]  LD   BC  3316
 POKE    244  3326
 ?       [illegible]
 UAL     197  3327  PUSH BC
 ?       79   3328  LD   C   A
 RETURN
         254  3333  CP   11
 ,       11   3330
 K       48   3331  JR   NC  11
 ,       11   3332
 S       [illegible]  LD   HL  3350
 ,       [illegible]
 ,       [illegible]
 ,       [illegible]  LD   B   0
 ?       [illegible]
 ?       [illegible]  ADD  HL  BC
 ?       78   3339  LD   C   [illegible]
 ?       [illegible]  ADD  HL  BC
 FAST    229  3341  PUSH HL
 TO      203  3342  RS24
 TAN     201  3343  RET
 TO      [illegible]  RS24
 [illegible]  [illegible]  CP   C
 4       [illegible]  JR   NZ  18
 ?       [illegible]
 SCROLL
         231  3348  RS32
 TAN     201  3349  RET
```

Figure 7.

Command	Class	Sep	Address
DEF FN	5		8032
CAT	0		6035
FORMAT	10		6035
MOVE	10	,	
	10		6035
ERASE	10		6035
OPEN #	10	,	
	10		5942
CLOSE #	0		5861
MERGE	11		*
VERIFY	11		*
BEEP	8		1016
CIRCLE	9		
	9		6992
INK	7		*
PAPER	7		*
FLASH	7		*
BRIGHT	7		*
INVERSE	7		*
OVER	7		*
OUT	8		7802
LPRINT	5		8137
LLIST	5		8133
STOP	0		7486
READ	5		7661
DATA	5		7719
RESTORE	0		7746
NEW	0		4535
BORDER	6		8392
CONTINUE	0		7775
DIM	5		11286
REM	5		7090
FOR	4	=	
	4	TO	
	6		7427
GO TO	6		7789
GO SUB	6		7917
INPUT	5		8329
LOAD	11		*
LIST	5		8137
LET	1		573
PAUSE	6		7994
NEXT	4		7595
POKE	8		7808
PRINT	5		8141
PLOT	5		8924
RUN	0		7841
SAVE	11		*
RANDOMIZE	0		7759
IF	5	THEN	
	5		7408
CLS	0		3435
DRAW	8		
	8		8090
CLEAR	0		7552
RETURN	0		7971
COPY	0		3756

Figure 9.

Class	Address
0	7184
1	7198
2	7244
3	7178
4	7272
5	7180
6	7292
7	7311
8	7282
9	7349
10	7298
11	7376

Figure 8.

```
  1 FOR a=6728 TO 6777
  2 LET x=x+1: IF x>16 THEN COP
Y : CLS : LET x=0
  3 LET b=a-6522: PRINT CHR$ b;
TAB 12;
  4 LET c=a+PEEK a
  5 PRINT PEEK c
  6 IF PEEK c=7 OR PEEK c=11 TH
EN PRINT TAB 21;"*": NEXT a
  7 IF PEEK c=9 OR PEEK c=8 OR
PEEK c=4 OR PEEK c=6 OR PEEK c=1
0 THEN GO TO 16
 10 PRINT TAB 24;PEEK (c+1)+256
*PEEK (c+2)
 13 NEXT a
 14 COPY
 15 STOP
 16 LET c=c+1
 17 IF PEEK c=0 THEN GO TO 10
 18 IF PEEK c=5 THEN PRINT TAB
12;: GO TO 5
 19 PRINT CHR$ PEEK c
 20 LET c=c+1: PRINT TAB 12;: G
O TO 5
 50 PRINT "Command   Class Sep
 Address"
 51 PRINT
 52 LET x=0
 53 GO TO 1
```

Figure 6.

```
 LPRINT   5          2753
 LLIST    5          1836
 STOP     0          3323
 SLOW     0          3883
 FAST     0          3875
 NEW      0          963
 SCROLL   0          3086
 CONT     0          3708
 DIM      5          5129
 FOR      4          3434
          4   =
          4   TO
 GOTO     6          3513
 GOSUB    6          3713
 INPUT    5          3765
 LOAD     11         3817
 LIST     5          952
 LET      1          1840
          1   =
 PAUSE    6          3713
 NEXT     4          3890
 POKE     8          3530
          8   ,
 PRINT    5          3730
 PLOT     5          2767
          5   ,
 RUN      0          2991
 SAVE     11         3759
 RAND     0          758
 IF       5          3692
          5   THEN
 CLS      0          3499
 UNPLOT   8          2602
          8   ,
 CLEAR    0          2991
 RETURN   0          5274
 COPY     0          3800
                     2153
```

Figure 5.

```
 10 FOR A=3113 TO 3144
 20 LET B=A-2888
 30 PRINT CHR$ B,TAB 12;
 40 LET C=A+PEEK A
 50 PRINT PEEK C;
 60 IF PEEK C=1 OR PEEK C=5 OR
PEEK C=4 THEN GOTO 100
 80 PRINT TAB 24;PEEK (C+1)+256
*PEEK (C+2)
 85 NEXT A
 100 LET C=C+1
 110 IF PEEK C=0 OR PEEK C=5 THE
N GOTO 80
 120 PRINT TAB 16;CHR$ PEEK C
 130 LET C=C+1
 132 IF PEEK C=2 THEN LET C=C+1
 135 PRINT TAB 12;
 140 GOTO 50
```

Figure 10.

```
 10 PRINT "Class      Address"
 20 FOR a=7169 TO 7180
 30 LET b=PEEK a
 40 LET c=7169+b
 50 PRINT "  ";A-7169;TAB 10;C
 60 NEXT A
 70 STOP
```

THE WORKING SPECTRUM

A LIBRARY OF PRACTICAL SUBROUTINES AND PROGRAMS

By David Lawrence

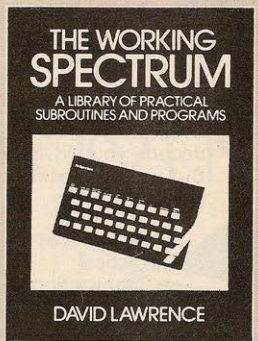
The Working Spectrum is based on a collection of solid, sophisticated programs in areas such as data storage, finance, calculation, graphics, household management and education.

There is also a chapter of utility routines including a Basic renumbering program which can handle GOTOs and GOSUBs.

Each of the programs is explained in detail, line by line. And each of the programs is built up out of general purpose subroutines and modules which, once understood, can form the basis of any other programs you need to write.

Advanced programming techniques spring out of the discussions explaining each subroutine. The result is not only to advance your programming skills but also to leave you with a wide range of practical applications programs which might otherwise only be available to those prepared to buy cassettes or those capable of writing substantial programs for themselves.

Expert or novice — whatever your experience, you will find this the most useful and valuable book for the Spectrum.



Please send me a copy of The Working Spectrum.

I enclose a cheque/postal order for £5.95.

Name.....

Address.....

.....

.....

Signed.....

Please make your cheques payable to Sunshine Books.

Please send your order to The Working Spectrum, Sunshine Books, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

We can normally deliver within four to five days.

YC

Buy from us with confidence
Full money-back guarantee on all our products

"Thank you once again for your prompt service; yours must be the most user-friendly company in the business!" G.S. Yorks

"I must congratulate you not only on the quality of your goods but also on your excellent service." G.W. Solihull

Quality software
ZX 81 Spectrum BBC Vic-20

GAMES CASSETTES

ZX81 (16K) SUPER INVADERS £4.95
On-screen league tables, animated instructions. Game in machine code — "excellent ... one of the two best . . . deservedly popular" (Pop. Comp. Weekly) "Great game!" S. F. Giles.

ZX81 (16K) LYNCHMOB £4.95
Exciting word game. 2-6 players. Excellent for the family. Great fun, educational too! Animation, on-screen scoring. Superb Xmas present.

Spectrum (16K) LYNCHMOB £6.50
As for ZX81 but with added excitement of colour, sound and hi-res animation.

VIC-20 (unexpanded) INVADERS £6.90
Machine code, colour, eight sound effects

BBC ("B") BRIDGEMAN £7.90
The popular gobbler game. Hi-res, colour, sound.

APPLICATIONS SOFTWARE on cassette

ZX81 (1K) GRAPHICS STARTER PACK £4.50
Four 1K Graphics programs on cassette with 12 pp. explanatory manual.

ZX81 (16K) MULTIGRAPHICS £6.90
A user-friendly package of procedures giving you full control of the ZX81 graphics functions to compose designs, drawings, adverts etc. Incorporates advanced sketchpad, 3 sizes of text (including power case), animation, printer output, SAVE displays etc. Businessmen use it to advertise at point-of-sale. 20 pp Manual.

Spectrum (48K) SPECTROGRAPHICS £6.90
Another superb user-friendly graphics program — hi-res and lo-res sketchpads, multisize text, etc. etc.

ZX81 1K STATISTICS £4.00
Mean, SD, variance, correlation, regression, t and F tests. 8 pp Manual includes listings, test data etc.

Spectrum (48K) STATISTICS (price includes maintenance) £9.90
Mean, SD, variance, correlation, regression, t tests. Hi-res graphic displays, data manipulation procedures.

EPHEMERIS ZX81 (16K) ..... £6.90 **Spectrum (16K, 48K)** £7.90
Interested in heavenly bodies? Input date, time and your position, Ephemeris computes altitude, azimuth, phase etc. etc. for sun, moon and planets.

16K RAM pack **Memotech Memopak 16** **£28.50**

Send s.a.e. for details of our products
All-inclusive prices. First Class return-of-post mail in U.K.
European customers add 30p per item; 70p Worldwide (Air Mail)
Available by mail order or from leading computer stores. Trade enquiries welcome.

Dept. YC, 36 Fernwood, Marple Bridge, STOCKPORT, Cheshire SK6 5BE, ENGLAND.

Bridge Software

VIEWPOINT

THE PROGRAM THAT YOUR ZX SPECTRUM HAS BEEN WAITING FOR!

Draw complex 3-dimensional objects. View them after rotation in any or all of 3 dimensions.
Features:

1) Rotation in 3 dimensions about a single point.
2) Rotation about a line between two points.
3) Generation of stereo pairs.
4) View from one point towards another point.

Objects can be stored separately on tape and copied to the ZX printer.
Written in BASIC for you to modify to your own requirements.
Ideal for computer modelling, molecular modelling, CAD etc.

Viewpoint - with full instruction and examples
£6.50

Just starting to write machine code programs? The ideal assembler for beginners is Ultraviolet. Look at the facilities that it offers:

Works entirely in decimal (no hex problems); all Z80 instructions correctly assembled; supports the pseudo-instructions EQU, ORG (multiple ORGs allowed), DEFB, DEFW and DEFS; code can be assembled at one location and then relocated; allows alphanumeric labels of any length; full listings of assembled code and mnemonics can be output to the printer; full error trapping with faulty instruction clearly indicated; comments can be included in the source file.

The ideal complement to Ultraviolet is Infrared - an easy-to-use disassembler.

So now there is no need to be intimidated by machine code - with Ultraviolet and Infrared it's child's play! Buy them from the machine code specialists - ACS Software.

ULTRAVIOLET - £7.50 **INFRARED - £6.75**

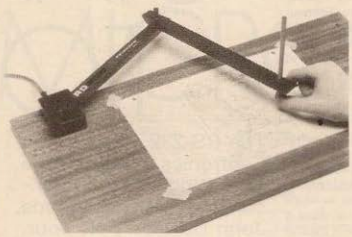
All our Spectrum programs will work in both 16K and 48K models. Please send sae for details of ZX81 programs.

ACS SOFTWARE 7, Lidgett Crescent, Roundhay, Leeds LS8 1HN

NEW

INSTANT IMAGE TRANSFER TO ZX SPECTRUM

RD DIGITAL TRACER £49.95



(unretouched printouts)

The high resolution colour graphics of The ZX Spectrum permit accurate presentation of complex or irregular images – maps, technical drawings, even personalities. But entering individual co-ordinates for unusual shapes can be tedious and time-consuming.

The new RD DIGITAL TRACER cuts out much tedious plotting. It provides instant transfer from original to display file – for screen display in colour, ZX printer printout, or retention on cassette.

The RD DIGITAL TRACER is of immense benefit in many fields – for geographers and weathermen, for engineers, architects and technicians, even for budding Leonardos! Designed for use with the ZX Spectrum, the RD DIGITAL TRACER as supplied is compatible with ZX 81, although high-resolution colour graphics cannot be obtained on this machine.

The RD DIGITAL TRACER is available only from RD Laboratories. The price of £49.95 includes P & P and VAT. Send your cheque now for delivery in 28 days. (Cheques payable to "RD Laboratories".) The RD DIGITAL TRACER is supplied with tracing sheet, software cassette, and full instructions on use.

Please send me ..... RD DIGITAL TRACER(S) at £49.95 each. I enclose payment of £ _____ . _____

Name: .....

Address: .....

.....

Send to: RD Laboratories, Dept. YCJ, 5 Kennedy Road, Dane End, Ware, Herts. SG12 OLU

RD Laboratories' policy is to bring sophisticated computer techniques to low-cost computing. RD Laboratories therefore maintain the right to amend specifications at short notice. Please send stamp for further details of the RD DIGITAL TRACER, and the RD 8100 SYSTEM for automatic monitoring, test and control.

R D Laboratories

5 Kennedy Road, Dane End, Ware, Herts. SG12 OLU
(0920) 84380

BBC COMPATIBLE

ELECTRONICS APPLIED, 4, DROMORE ROAD, CARRICKFERGUS, Co. ANTRIM BT38 7PJ
Please add 55p for P & P

MAIL ORDER ONLY

MAIL ORDER LIST SEND LARGE S.A.E.

software

5% discount

Envelope and Character Definer. (32k)

Together these utility programs offer a complete character and sound envelope defining package for the BBC Micro. Even if you fully understand both the envelope and character defining commands, these programs will make their definition quicker and more accurate.

Side 1

ENVELOPE DEFINER
- Excellent user friendly windows and colour to display pitch and volume.
- Database containing 20 predefined envelopes and everything from phasers to explosions.
- Example graphs and step by step programs easy defining of your own sound envelopes.

Side 2

CHARACTER DEFINER
- A very powerful character definition program! — *Computer Users Club (GB)*
- Shows both magnified and true size characters on the screen.
- All other definable characters can be called up for display.
- Easy to use and check performed on all input.

Recorded on quality cassettes, sent by first class post

Introductory Price £4.95

Dealer Enquiries Welcome

ELKAN ELECTRONICS

Special Christmas offers on SHARP pocket computers

PC1500	£159.95
CE150 4 colour printer	£139.95
CE151 4K Ram	£39.95
CE155 8K Ram	£69.95
NEW CE159 8K Ram with 5 year battery	£79.95
CE153 Software panel	£79.95
NEW CE152 Computer cassette recorder	£39.95
NEW CE158 RS232 Interface	£139.95

NEW World Exclusive PC1500 Software from GEMINI
Silicon Notebook **£19.95**
Executive suite £29.95

BRAND NEW! Easicalc 1500 (Visicalc-type) . . **£19.95**

Send cash, cheque, Access or Visa Card No. Ask for our New FREE pocket brochure. Trade enquiries welcome anytime.

ELKAN ELECTRONICS (Dept. YC2)

FREEPOST, 28 Bury New Road, Prestwich, Manchester M25 6LZ or telephone 061-798-7613 (24 hr. service). See full list on Prestel 258 2022.

We specialise in pockets!

CONTROL STAN FOR

The RS-232 and the Centronics interfaces are two standard computer communication methods. John Dawson puts your micro in touch with reality.

YOU MAY not be aware that there were several earlier electrical methods of sending messages that were largely superseded and made obsolete by the Morse code. These other methods were parallel channels of communication in that they required several wires. A piece of information was transmitted by setting each of the wires on or off at the same time. The first practical telegraph system was invented in 1837 by Sir Charles Wheatstone and W F Cooke and it was known as the Five Needle System. Five wires were required for signalling, and either the earth or a sixth to complete the circuit.

Clearly, systems that needed several wires to connect one station with another were no match for a serial method in which two wires could carry a message by sending the elements of a piece of information one after another. And so the Morse code triumphed. It was the universal standard means of long distance communication between humans for many years and is still used widely in both commercial and amateur radio transmission. Morse code allows two way communication between people who cannot speak the same language and has been used for the automatic transmission of data from devices such as weather balloons as well as the transmission of free text.

Another serial system was developed in 1874 and used for machine- to-machine communication. The Baudot code has five bits that make up each piece of information and telexes and teleprinters still send and receive information using an internationally-approved version of the 19th century Baudot code.

This article concerns two standard computer methods of communication. The first is a widely-used serial interface — the RS-232, which is slowly being upgraded to the RS-432. The second is the ubiquitous Centronics interface. Both are almost universal interfaces on hundreds of thousands of domestic and commercial computers.

```
PCHAR   PHP
        PHA
        STA   $BFE1
PCR1    LDA   $BFE0
        AND   # 4
        BEQ   PCRZ
        LDA   $BFED
        AND   # 2
        BEQ   PCR1
        PLA
        PLP
        RTS
PCRZ    LDX   # 8      ; /// Printer error
        JMP   ERROR
V2POP   PHP
        PHA
        LDA   # 0
        STA   $BFE3
        LDA   # $FF
        STA   $BFE3
        LDA   # $A
        STA   $BFEC
        LDA   # $7F
        STA   $BFEE
        LDA   $BFE0
        AND   # 4
        BNE   V21
        LDX   # 8      ; /// Printer error
        JMP   ERROR
V21     PLA
        PLP
        RTS
```

Figure 4. Program to set up a VIA.

Rather than confuse the issue by looking into the entrails of a complex micro, I intend to base a simple Centronics interface on the Microprofessor computer. The MPF-I computer is a good testbed for small programs of this sort and, like all computers, its value is increased greatly when it has the ability to produce hard copy by printing data and results on paper.

The ideas in this article apply to most microcomputers. The Acorn Atom has a VIA chip that can be used to acquire information from the real world by connecting analogue to digital converters or on/off switches to single bits, just as easily as it is used to drive a printer. If your micro does not have a Parallel Input/Output — PI/O — or Versatile Interface Adaptor — VIA — chip on the basic board it will almost certainly have a bus offering all the connections to the central processor unit — CPU — that you need to wire up a parallel port.

The Jupiter Ace falls into this class. Although the programs in this, and the subsequent article, will be in assembly language there is no reason why the few values that have to be set for either chip cannot be Poked into place with Basic. By doing this with the Oric, for example, you will be able to use the second timer for timing parts of games or to set up the machine as a frequency counter.

What is an interface? There are five elements of a complete interface specification for connections between two pieces of electronic equipment.

First, the mechanical connectors — the design of things like the diameter and shape of the pins and the plug retainers.

Second, the electrical design, the voltage levels on each pin, for example, and the permissible capacitance in the line.

Third, the functions of devices connected to the interface. The IEEE 488 interface classifies devices as "talkers", "listeners", or "controllers".

The fourth interface specification element concerns the communications protocol, which is an agreement that certain codes sent along the interface will be treated in the same way by all the devices that may be connected to the interface.

Fifth comes a higher level protocol which defines the use made of information by each machine. High-level protocols are necessary, for example, to route messages and ensure privacy.

Both the RS-232 interface and the Centronics parallel interface contain parts of both one and two in the list. Pin connections for versions of both interfaces are set out in figure 1. It is surprising that a "serial" interface should have almost as many connections as a parallel one, but the protocol for the RS-232 interface allows for a number of wired control functions as well as the transmission of data in both directions at once. Remember that the difference between serial and parallel is that information is transmitted down an RS-232 link one bit at a time, while the Centronics interface used in the Epson MX-80F/T and other printers carries eight bits at a time along the data bus — data 1 to 8. Many RS-232 connections can be made successfully using only four wires — a small selection from the total.

There are almost as many varieties of the RS-232 interface as there are equipment manufacturers. If a salesman ever offers you a "standard" RS-232 link, just make sure it works before you buy and do not expect to be able to connect the printer, or whatever peripheral device it is, to another machine without doing some rewiring.

You can set up a non-standard or standard serial link using the cassette port and your own software. I hope to do this in future, modelling the Computer Users' Tape System — CUTS — in software on the MPF-I and connecting this machine to an RML-380Z.

At present, though, I want to print out machine-code listings of fundamental subroutines to extend the MPF-I monitor capabilities. The basic MPF-I has a socket for a PI/O chip. The PI/O is a Zilog Z-80 range product that is matched by 6502 manufacturers with the 6522 Versatile Interface Adaptor. The main difference between the systems into which the chips fit is the memory-mapped approach taken by the 6502 as against the I/O port system used by the Z-80.

In the 6502 architecture, peripheral devices are treated simply as memory locations to which data can be sent and from which information can be read. The Z-80 uses the lower eight bits of the address bus to identify up to 255 ports for data I/O purposes. The 6502 CPU has no separate IORQ and MREQ lines.

Each PIO or PIA/VIA is essentially similar to any other. The purpose of the chip is to act as a multiport input/output device in which a port is simply a set of eight wires carrying a signal in parallel — an eight-wire needle system — Sir Charles would have been proud! In addition to the eight data bits the PI/O chip must have a way of agreeing with the peripheral device that a transfer of data has taken place. This is done by "handshaking", a process in which data is placed on the output of the PIO and one of the control lines is used as a strobe, which means that it can be made to

DARD INTERFACES MICROS

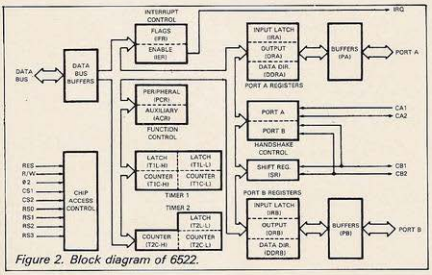


Figure 2. Block diagram of 6522.

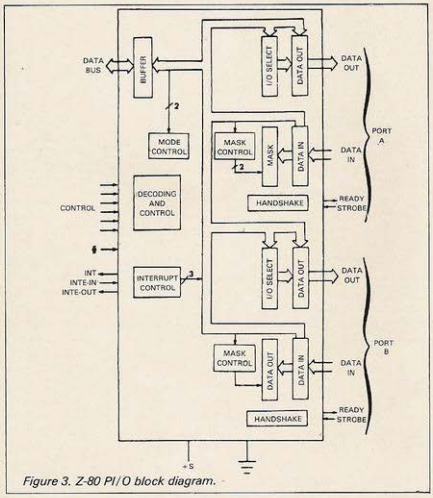


Figure 3. Z-80 PI/O block diagram.

Signal Pin	Return Pin	Signal	Direction	Description
1	19	STROBE	In	Strobe pulse to read data in. Pulse width must be more than 0.5µs. at receiving terminal. The signal level is normally "High"; read-in of data is performed at the "Low" level of this signal.
2	20	DATA 1	In	These signals represent information of the first and eighth bits of parallel data respectively. Each signal is at "High" level when data is logical "1" and "Low" when logical "0".
3	21	DATA 2	In	
4	22	DATA 3	In	
5	23	DATA 4	In	
6	24	DATA 5	In	
7	25	DATA 6	In	
8	26	DATA 7	In	
9	27	DATA 8	In	
10	28	ACKNLG	Out	Around 5µs. pulse. "Low" indicates that data has been received and that the printer is ready to accept other data.
11	29	BUSY	Out	A "High" signal indicates that the printer cannot receive data. The signal becomes "High" in the following cases: 1. During data entry 2. During printing operation 3. In OFF-LINE state 4. During printer error status
12	30	PE	Out	A "High" signal indicates that the printer is out of paper.
13	—	SLCT	Out	This signal indicates that the printer is in the selected state.
14	—	AUTO FEED XT	In	With this signal being at "Low" level, the paper is automatically fed one line after printing. The signal level can be fixed to "Low" with DIP SW pin 2-3 provided on the control circuit board.
15	—	NC		Not used.
16	—	OV		Logic GND level.
17	—	CHASSIS-GND	—	Printer chassis GND. In the printer, the chassis GND and the logic GND are isolated from each other.
18	—	NC	—	Not used.
19 to 30	—	GND	—	Twisted-pair return signal GND level.
31	—	INIT	In	When the level of this signal becomes "Low", the printer controller is reset to its initial state and the print buffer is cleared. This signal is normally at "High" level, and its pulse width must be more than 50µs. at the receiving terminal.
32	—	ERROR	Out	The level of this signal becomes "Low" when the printer is in — 1. Paper End state. 2. Off-Line state. 3. Error state.
33	—	GND	—	Same as with pin numbers 19 to 30.
34	—	NC	—	Not used.
35	—	—	—	Pulled up to +5V through 4.7KΩ resistance.
36	—	SLCT IN	In	Data entry to the printer is possible only when the level of this signal is "Low". Internal fixing can be carried out with DIP SW 1-8. The condition at the time of shipment is set "Low" for this signal.

Figure 1. Centronics interface on MX-80.

output a pulse when the information on the data lines is stable and ready to be transferred to the receiving device.

Following this the data is left on the output port until the receiving device sends a signal along the other control line for that port to say that it has the data safely on board.

Block diagrams for the two chips are set out in Figures 2 and 3. In addition to acting as two eight-bit latched I/O ports the 6522 also contains two very useful counter timers. On the Microprofessor computer board the hardware timers are provided by a counter timer circuit — CTC — chip.

A simple but adequate Centronics interface can be established using only the Data, Busy, Acknowledge, and Strobe lines — the Acorn Atom is an example and the Nascom 1 computer interface was even simpler, omitting to take account of the Acknowledge signal from the printer to say that the data had been received, and using the Busy signal alone.

Figure 4 illustrates a working program — V2POP — to set up a VIA on the Tangerine computer as a parallel output for a Centronics printer interface and another subroutine — PChar — which prints a character. The memory map values — $Bfe3 and so on — are specific to the Tangerine and will require alteration for your own system. ■

Your hands will sweat. Your heart
Your oxygen might run out. And you're still

will beat faster. only sitting in an armchair.

At seventy fathoms the only light comes from your Sonar, steadily tracking the advancing enemy fleet.

Suddenly they're above, dropping depth charges. You could dive. But how close is the sea bed? You could attack. But how many torpedos are left? And your oxygen. Isn't it dangerously low?

Submarine Commander: 12 K ROM. Cartridge. 3 screen modes: map, sonar and periscope. 9 skill levels. Controls: Fuel. Damage Indicators. Speed. Compass Bearing. Depth Gauge. Battery Charge. Oxygen. Hydrophone/ Engine Noise. Attitude. Clock. Depth below keel. Torpedos. Tonnage Sunk.

'Submarine Commander' is one of 21 challenging new home computer games from THORN EMI, for use with Atari 400/800 or Commodore VIC 20. Like our 'Jumbo Jet Pilot' it's more a real-life simulator than a game.

But our programs aren't all work and no play. 'River Rescue', 'Kickback' and 'Soccer' are all-action games. 'Pool' and 'Darts' will suit armchair sportsmen.

And whilst budding Beethovens play the 'VIC Music Composer,' would-be Chancellors can work on their budgets with 'Home Financial Management.' We also have educational puzzles for children that will puzzle adults at higher skill levels.

But there's one simple idea behind all our titles. They're designed for players who expect more of a challenge from a video game than creatures from outer-space can provide. Now, are you sitting comfortably?

THORN EMI VIDEO

The world's greatest TV games.

PROGRAMS FOR ATARI 400/800 (Trademark of Atari Inc. except where indicated). *PROGRAMS FOR COMMODORE VIC 20 (Trademark of Commodore International).

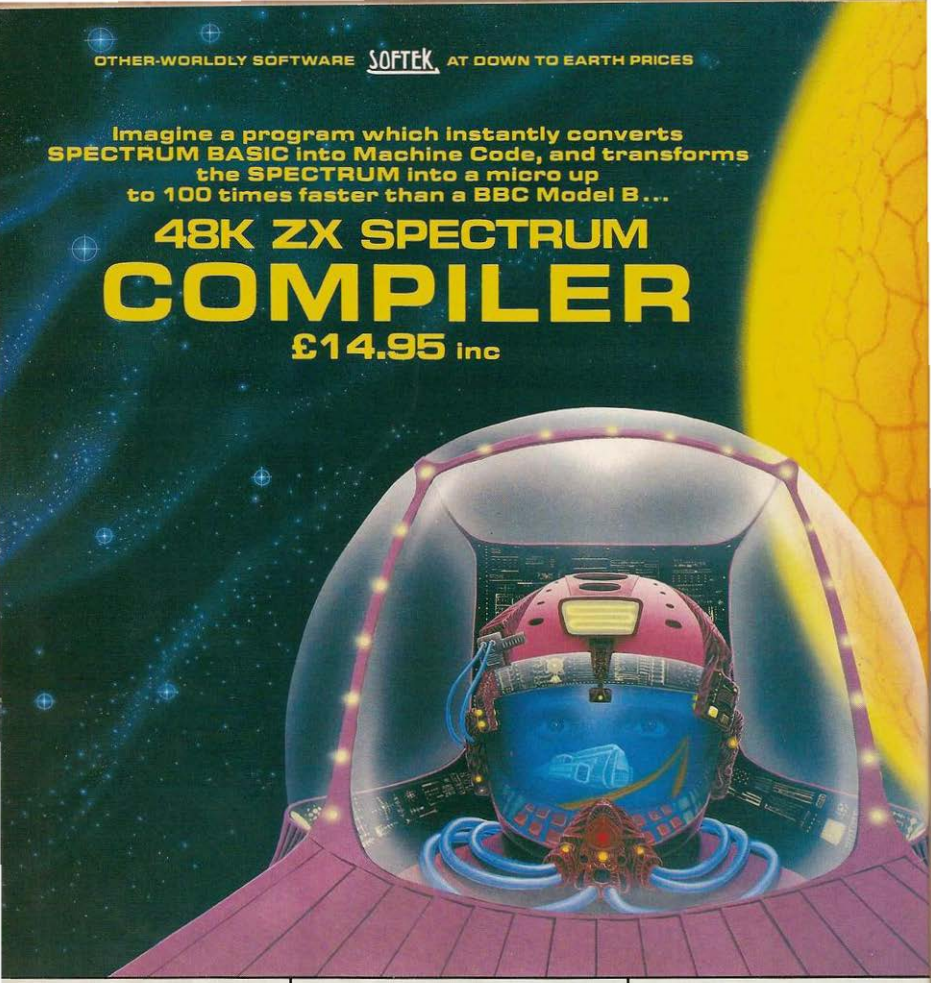
Available from all branches of Laskys (Nationwide), Micro C at Currys, and all other leading Computer software outlets.

OTHER-WORLDLY SOFTWARE SOFTEK AT DOWN TO EARTH PRICES

Imagine a program which instantly converts SPECTRUM BASIC into Machine Code, and transforms the SPECTRUM into a micro up to 100 times faster than a BBC Model B...

48K ZX SPECTRUM COMPILER

£14.95 inc



METEOROIDS

This version has been hailed the best: 3 sizes of meteoroids, saucer, wrap-around screen, bonus ship at 10000 points, amazing explosions, rotate left/right, thrust, fire, hyperspace and shield. Full feature 'arcade' sounds and full colour. Works with Joysticks (from us at £19.50). Only £4.95 inc (16K or 48K).

SOFTIME

Amazing piece of machine code programming–produces a continuous real time clock on screen all the time–even when running/writing another program! Has alarm facility. For 16K or 48K, only £3.95.

SOFTEK SPECTRUM SOFTWARE

COMPILER Benchmarks

	BBC	SPECTRUM (BASIC)	SPECTRUM (COMPILER)
BM1	1.0s	4.8	0.15
BM2	3.1	8.7	0.09
BM3	8.2	21.1	1.10
BM4	8.7	20.4	0.99
BM5	9.1	24.0	1.11
BM6	13.9	55.3	1.91
BM7	21.4	80.7	2.14

What the SUPER C compiler does is almost magical. It turns a program written in Spectrum BASIC into a machine code equivalent. SUPER C is child's play to use–simply type in a program as usual (or load from tape) and in a few key presses SUPER C turns it instantly into a super fast machine code version. It will compile virtually any Spectrum BASIC statement, plus a few features not available to you usually, but extra thought will be required for strings and floating point. There is no program you can write in BASIC which cannot be turned into a SUPER C version. However, enhancement packages will be available in the New Year to aid string handling, floating point, and will offer a host of other features–each for a nominal cost. With SUPER C your Spectrum will run faster than with either FORTH or PASCAL–and no new language to learn! SUPER C comes complete with extensive documentation, a manual written by Tim Langdell, example programs, and all boxed in a professional library case. Less than half the price of a compiler for any comparable micro,–£14.95 inc.

48K 3D MAZENTURE

A maze program and adventure in one. Amazing 'monster chase' animation and more than a hint of dungeons and dragons. 48K only, £5.95.

THE ZOLAN ADVENTURE

A full adventure crammed into 16K! Quite astounding how extensive and engaging this program is. £4.95.

Please rush me . . . . . .

. . . . . .

Mr/Mrs . . . . . .

Address . . . . . .

. . . . . .

or for INSTANT CREDIT CARD order 7 days a week phone: 01-930 9232.

Send cheques or POs to: 329 Croxted Road, London SE24. Tel: 01-674 4572

SOFTEK, SPECTRUM SOFTWARE

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

BREAK-IN

■I am a ZX-81 owner, and have a collection of software for my machine. A few of these programs consist entirely of machine code, which makes it impossible to break into the program. Can you suggest any way in which I can break into this kind of program so it can be saved on to another tape?

Bradd France,
Handsworth, Birmingham.

ONE OF THE reasons the tape cannot be broken into is to stop tape-copying. Copying a program to give to someone else is, in effect, stealing the program, and depriving the programmer and the manufacturer of the tape their rightful royalties. Even though routines do exist to break into machine-code tapes, it would be highly irresponsible for us to publish them.

ZERO SET

■I have a Video Genie. I have found out that by using Goto a line number, rather than Run, I can execute a program over and over again from different points, but still have the variables in the program from a previous execution. However, by inserting or deleting lines, all variables are set to zero. Is there any way to get around this?

G Kowalczyk,
London N9.

UNFORTUNATELY, there is no simple way to get the variables to retain their value after an edit. When you change the length of the program, it could overwrite the variables store, so to avoid error, the Genie does a Clear every time Edit is used.

CAREER CHOICE

■Our son, who will shortly be 13, is considering purchasing his first computer. He favours the ZX Spectrum. He will be taking Computer Studies at a later date at school, and is considering becoming a programmer.

In your opinion, would this be a good choice of computer for him?

Mrs Y Smith,
Tolleshunt D'Arcy,
Maldon.

THERE IS PROBABLY not a single computer on the market in the under £400 range which would not be worth getting. Even the ZX-81 can take a person a long way into the field of computing. The only real problem facing the Spectrum has been the long delivery delays. If you want a computer tomorrow, you can get most other models off the shelf. I suggest you work through the following checklist of questions before you make the final decision on which computer to buy. How much can I afford to pay? What are the three main things I will use the computer for? How much memory will I need for these? Which two or three computers fulfil the above requirements? Is there a store near me which sells and services these? How many of these computers have been sold? Are there letters in the magazines complaining of particular, persistent problems with the machines I am considering? Is there a range of suitable software available? How much does extra memory cost? Is Basic on-board, or will I need to "boot it up" with a plug-in cartridge or cassette? Are the machines under consideration supported by an active users' group? Do the machines under consideration save and load programs on to an ordinary cassette recorder, or would I have to buy a special recorder? If a special recorder is required, how much does it cost? Is the quality of the printer output of the computer good enough for my needs? If you work through these questions, you should find the choice of computer easy to make.

CUBEMASTER

■I own a ZX Spectrum and have a problem. When trying to enter the Cubemaster program from the February, 1981 issue of *Your Computer*, written for a 16K ZX-81, I struck a serious problem. My 16K Spectrum decided to run out of memory at line 3050. I was particularly annoyed at this as it had taken about four hours solid programming to get this far. Why will this program fit in a 16K ZX-81, but not in my machine?

Simon Hillyer,
Naseby,
Northampton.

ALL COMPUTERS use up memory maintaining the display. About 1K is used on the ZX-81, but a massive 9K is used up for the high-resolution graphics on the Spectrum. Therefore, whereas you have, more or less, 15K to play with on a 16K ZX-81, you have only 7K on a Spectrum. Many other high-resolution computers — like the BBC Microcomputer — allow you to decide if you want the memory to be used for the display, or whether you will accept a lower screen resolution in return for more program memory. You do not have this option on the Spectrum. Although I doubt if you will squeeze Cubemaster into a 16K Spectrum, many other programs which are marked 16K ZX-81 are, in fact, far less than this, so you should be able to convert them for the Spectrum. If you are in doubt, leave out the instructions, and all Rem statements. You may well find you can put the instructions back in later, but I suggest you omit them the first time you try a ZX-81 program on the Spectrum.

NO LICENCE

■I would like to know how the law stands on using a television with a computer. I have purchased a Sony 14 in. portable TV to use with my Spectrum. Do I have to pay £46 for a TV colour licence to watch my Spectrum?

Philip Graham,
Dallas Road, Lancaster.

THE LAW ON use of television sets only relates to their being used to receive broadcast signals. Although I not not believe the use of a television as a visual display unit for a computer has been tested in court, a recent decision was made in favour of a man who had been taken to court for watching video tapes on an unlicensed set. The court found in his favour, that is no licence was required if the set was not used to pick up broadcast signals.

GREEN SCREEN

■I would like to know if a green screen monitor may be connected to a ZX-81. If it can, how do I do it? I would like a green, 9 in. or 12 in. monitor, preferably under £100. I have been looking at the Zenith monitor. Would this be suitable for the ZX-81? Do I need additional hardware?

J A Capless,
Mickleford, Leed.

YOU'LL FIND, of course, that a monitor will give better results than a domestic television. The Timedata *ZX-81 Magic Book* gives details of the hardware modifications needed to connect a monitor to a ZX-81. You may well find that you get a perfectly acceptable result without actually making the modifications.

NEAT FIGURES

■I own a ZX-81. As you know, the computer prints from left to right, starting at the left-hand margin. This is fine for text, but produces very untidy-looking columns of figures. Could you please help me with a routine to produce neat rows of figures?

E Matos,
Sparkhill,
Birmingham.

THE EASIEST way to do this is to treat the number as a string, and from the length of the string, determine where across a line printing should begin. Run the following program, and you will see that no matter how large or small the number, the computer lines the numbers up correctly. Exit from the program by entering any letter except A.

```
10 INPUT A
20 LET A$=STR$ INT A
30 PRINT TAB 15-LEN A$;
40 IF A=.09999 THEN PRINT " ";
50 PRINT A
60 GOTO 10
```

HELP WITH FORTH WRITING

■I own a Jupiter Ace, and am gradually getting to grips with Ace Forth. However, I was wondering if there was a simple way to remember which words are in the language on board, rather than having to constantly refer back to several different pages in the manual.

Ian King,
Pollokshields,
Glasgow.

THE FORTH command VList will cause the Ace to fill the screen with its words. It also makes an instant demonstration of the Ace, for when you feel frustrated and think you will never be able to master the language.

FULLER EXCUSE

■ I ordered a Fuller FD-42 keyboard for my ZX-81 at the Computer Fair on April 24, for which £37.50 was paid. Fuller Micro systems cashed the cheque on April 29, and sent me an acknowledgement on May 1, asking me to allow them 28 days delivery. After writing them many letters and finally informing them I was preparing to take them to the Small Claims Court the keyboard arrived on July 5. It was found to be faulty within an hour. The keyboard with a letter was returned to Fuller asking for a refund. The keyboard was sent back to me with no changes to my knowledge, as it still had the same fault. Please could you help me.

A R Weaver,
Swindon,
Wiltshire.

I SENT FULLER a copy of your letter, asking for comments, and the reply from Keith Archer did not explain the long delay in delivery, nor did he say why he did not refund your money when you asked for it. I am not sure what the law says, but I would think that as a courtesy if nothing else, a customer unhappy with a mail-order product should be able to return it in good condition and get his money back, no questions asked. Mr Archer believes the fault displayed by your keyboard — the 8, 1, K and M keys not working — is due to an RP-2 resistor pack missing from the ZX-81. He says he has offered to replace yours free if you send your ZX-81 to him, but this you have decided not to do. I suggest you show them this answer in the magazine, and request your money back again. If you do not get it, please write to us again. ■

COMPUTER RENTALS LIMITED

140 Whitechapel Road, London E.1. Telephone: 01-247 9004

ALL PRICES INCLUDE VAT. DEALER ENQUIRIES WELCOME

HORSERACING for the 48K Spectrum

Gambling on any horse in the field up to 5 players can lay bets with Honest Clive Spectrum the bookmaker as the horses circle in the parade ring. Will Clive keep that smile? Watch the race begin as the tape lifts and marvel at the amazingly realistic 3D perspective animation as the riders jockey for position. See the horses and riders in full flight as they pass Spectators (no pun intended) and into the home straight past the stands. Hold your breath at the slow motion finish. Sound and Colour is used to it's fullest in this 22K of superb programming. Not recommended for compulsive gamblers. **Only £6.95 inc P&P**

ST GEORGE & THE DRAGON for the Dragon 32

Can you Slay the Fire breathing Dragon! Can you cross the slippery bridge and smite the magic stone to lift the curse from the castle and it's beautiful maidens? Don't get roasted by the dragon and mind the river and pond. If you fall in, your armour will send you to a watery matyrdom. Two versions for Joystick and keys are contained on the tape. Using sound, the program also pushes the Dragons High Resolution to it's full capabilities. **Only £6.95**

GALACTIC PATROL for the 16K ZX-81

Galactic Patrol is a fully Machine Code 'State of Art' ZX-81 'Star Trek'. With 819 levels of play, Phasers, Torpedos, Automatic sights, Scanner with on/off, distance, number and vector, Shields, Starvase vestor, Warp drives (speeds 0-8), damage control, fuel counter, flight vector, repair facilities, instructions reminder facility, stardate and kills counter. The Enterprises screen is graphically simulated with passing stars, dazzling speed, dramatic damage and kill effects. Destroy as many Klingons as you can and dock with the Starbase before you run out of energy, but be careful you can lead the Aliens on and they will destroy the Starbase itself. **Only £4.95 finc P&P**

RESCUE for the 48K Spectrum

How can we Summarize in a short ad, an adventure game that needs a Special Program to detail it's Rules! Very, VERY simply, you must find the Map and Radio then plot your route and monitor patrols as they scoure the 40+ locations you are travelling through. If you have the right equipment you can cross into Secret territory in search of the Castle and the imprisoned Princess. If you manage to find it and gain entrance there are many trails and tests. If you manage to find the Princess you must still return to base with her. Utilises all the Spectrum's facilities and takes hours to play. **Only £5.95**

JD ARCADES for the 16K ZX-81

Completely MACHINE CODE, JD Arcades contains 3 Menu selected games that will tax your strategy to their limit. Defuse an Unexploded Bomb by neutralizing the moving tumblers in order with your probe (or ELSE). Then you must beat the fuse to the detonator as around the circuit it snakes. In Strategic Invaders, you must destroy as many Invaders as you can, having only 9 shots from each column position. Can you think and dodge fast enough? As you fly In Laser Patrol you must destroy as many Asteriods with your salvoes as you can. How long will your shields hold out. **Only £4.95**

U.F.O. for the Dragon 32 + Joystick.

In the depths of Space you face a UFO mothership in head to head combat. Dodge the approaching Photon torpedoes or shoot them for points as the UFO fights back. Evenly matched, this is no walk over for the defender of Earth. When the UFO is in range, so are you! Hi-res is used to it's limit and you can even see the UFO's port open as it releases it's deadly weapon, it can even duck below the nose of your craft to reappear again and attack. **Only £6.95**

HANDICAP GOLF for the Dragon 32

An 18 hole, 1 or 2 player handicap game. There are Bunkers, the Rough, Lakes, Trees, gorse bushes and gusting wind which all have to be taken into account as you choose the strength and direction of your shot. The Computer decides the length of the hole and it's par, making sure you never, EVER play the same hole twice. Watch the Dragon 32 build up the hole in a fascinating graphics routine. Full use of sound and colour. Only £6.95 inc p&p

ZX81 16K RAMPACKS

WHY NOT buy now, one of the super new RAM PACKS from GROUND CONTROL? The standard version gives 16K of user ram, while the (S) version is fitted with a keyboard sounder enabling much faster entry of programs and less eyestrain due to audible feedback every time a key is pressed. The well engineered case ensures a snug fit to the ZX81.

NOW WITH

PRICES. (All inclusive for U.K.)

16K RAM PACK (S) £24.95

STANDARD RAM PACK £19.95

Euro post add £2.00

Availability is usually by return for credit cards, 5 days for cheques. There is a 14 day money back guarantee if not satisfied. Please send SAE or IRCs with all enquiries.

Make cheques/P.O.s. payable to GROUND CONTROL and send to: GROUND CONTROL, Alfreda Avenue, Hullbridge, Essex SS5 6LT.

Tel: 0702-230324. (Mon-Fri 9-5)

*Access/Barclaycard no. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

*Cheque/P.O./Cash.

*Delete if not applicable

Please send me: no. *STANDARD RAM PACK/ 16K RAM PACK (S)

NAME _____

ADDRESS _____

_____ Postcode _____

SPECTRUM NEWS FROM ELR

EAST LONDON ROBOTICS

Just received your ZX SPECTRUM? No point in looking any further—we have the products you need at the prices you expect.

SP48

32K Memory extension
(giving total of 48K. Upgradeable to SP80)

£25

SP80

64K Memory extension
(giving massive 80K)

£50

Both the SP48 and the SP80 fit inside the Spectrum case, are fully compatible with all Sinclair add-ons (ZX Printer, RS232, Microdrive etc.), are very low in power consumption, require no soldering, are easy to fit and remove and carry our full guarantee.

Transfer your ZX81 BASIC and machine code programs and data onto your Spectrum in minutes with the fabulous new

ZX SLOWLOADER

SOFTWARE PRODUCT OF THE YEAR

£10

This superb piece of software enables your Spectrum to LOAD programs from ZX81 tapes and automatically converts them to 'Spectrumese' ready for normal Spectrum SAVEing.

ORDERS & ENQUIRIES

Send s.a.e. for **FREE** catalogue to:
East London Robotics, Finlandia House, 14 Darwell Close, East Ham, London E6 4BT Tel: 01-471 3308

Prices include VAT. Please tick if you require VAT receipt ☐

Please rush me	Item description	Quantity	£	p
		P&P	45	

I enclose cheque/PO payable to East London Robotics for TOTAL £ _____

Name: Mr/Mrs/Miss _____ Address _____

EAST LONDON ROBOTICS—THE OPTIMUM SOLUTION

FINGERTIPS

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

LET ME BEGIN this month by reminding you that there is now a fully-fledged Hewlett-Packard users club in the United Kingdom. Membership entitles you to the bi-monthly publication of the society, *Datafile*, which is crammed with contributions from some of the current 130 UK members. I'm glad to say that sometime contributor to this column, Frank Wales, features prominently in the articles.

Subject matter tends to vary from analysis of new HP machines like the 15C and 75C, to full explanations of synthetic programming. As expected the HP-41C figures prominently in contributed programs and not all communications are as esoteric as "I am planning to properly document a program I have recently written to design or analyse storm sewers by the Wallingford Procedure Modified Rational Method." Anyone interested in this highly-recommended club should contact: PPC-UK, Astage, Rectory Lane, Windlesham, Surrey.

I used to recite poems about the Grand Old Duke of York to help me remember resistor colour coding — those days are now gone. Not only have I forsaken electronics but Stephen Godfrey of Hayling Island has written a conversion program for colours to resistance and vice-versa for the Sharp PC-1211. Stephen adds the following space-saving tip for the PC–1211; When entering lines which have the following format.

```
10 INPUT "INPUT VALUE OF
X:"; X
```

You can save several steps by reserving the keyword INPUT to a key, say Shift-M and then entering:

```
10 Shift-M "Shift-M of X:";X.
```

The computer then stores the word Input inside the quotes as one step which saves five as it includes a space at the end, too.

Nigel Gerdes of Dorset encloses a program which "takes the Casio FX-3500P to the limit of its programming ability!" He uses it in teaching students about communications networks, where the one sticky formula is inverse Cosh in the otherwise straightforward solution of networks. Continuing our efforts to provide useful "workhorse" programs, here is a Bessel function program for the TI-59 from L Weaver of Sussex.

Engineers and physicists who require Bessel functions for their work can often waste a great deal of time searching for sufficiently extensive tables. The attached short program for the TI-59 will calculate $J_r(x)$ to five figure accuracy for values of r between zero and 15, and x equal to or less than 6.

The basis is the recurrence relation $J_{n+1}(x) = (2n/x)J_n(x) - J_{n-1}(x)$. The trick is to realise that $J_n(x)$ tends to zero rather quickly as n increases. The program assumes that $J_{15}(x)$ and $J_{14}(x)$ are both zero, then starting from these trial values all other orders down to $J_0(x)$ can be calculated. These are individually stored.

However, these values are wrong by a factor which is calculable from the fact that $J_0(x) + 2J_2(x) + 2J_4(x) .... = 1$. This is also computed and divided into the original value.

To use, insert x and press A. After a few seconds the calculator stops with a value in the display which must be retained. Then insert r and press B, which will print out the required $J_r(x)$.

This program can easily be adapted to other calculators, or in fact to micros. A better accuracy can be obtained by starting with a higher original value of n than 15.

Finally we have a learning program from P Preece of Shropshire. Perhaps someone can develop the idea for more complex uses.

This program, designed for the Casio FX-180P, will test all four basic binary operations that is, addition, subtraction, multiplication, division and can suit people of different ages and help solve their difficulties in particular areas.

There is a round of questions which you have to answer. To get to the next round you must give the correct answer for a number of questions — preset by you — in a row. So getting the ninth question wrong, for example, resets your score to zero. This is best explained by the following diagram:

a) ROUND 1
   X+X=
   Get answer correct for Y times in a row
   ROUND 2
   X+X+X=
   etc.
b) SEQUENCE FOR LOADING
   PROGRAM
   MODE O
   INV PCL Clear
   INV KAC all
   INV MIN memories

Press the AC key, tap the value of u then press the P1/P2 key (the program should have been loaded in P1 store). At the first Ent display tap the value of v and then the run key. At the second Ent, display the value of u, and at the third and last the value of v. Press the Run key to continue as before.

The first displayed result will be the value of v. When ready press the Run key and the final result will be the value of V.

Note. Make sure the calculator is in Mode 5 (ie radians) for the correct results.

(continued on next page)

```
5 PAUSE "***RESISTOR CONVERTOR***"
10 CLEAR :N#="SILVER":O#="GOLD":P#="BLACK":O#="BROWN":R#="RED":S#="ORANGE"
20 T#="YELLOW":U#="GREEN":U#="BLUE":V#="VIOLET":X#="GREY":V#="WHITE"
25 X=1E3:M=1E6
30 PAUSE "YOU MAY FIND:":PAUSE "1 - VALUES FROM COLOURS"
40 PAUSE "2 - COLOURS FROM VALUES":PAUSE "3 - END"
45 INPUT "INPUT OPTION":A#:GOTO 50
46 BEEP 1:GOTO 30
50 IF A#="1"THEN 80
60 IF A#="2"THEN 220
62 IF A#="3"END
65 BEEP 1:GOTO 30
80 INPUT "FIRST COLOUR":B#
90 INPUT "SECOND COLOUR":C#
100 INPUT "THIRD COLOUR":D#
110 FOR L=2TO 4
120 FOR J=14TO 25
130 IF A#(L)=A#(J)LET A(L*3)=J-16:GOTO160
140 NEXT J
150 BEEP 1:PAUSE A#(L):" IS INVALID.":INPUT "PLEASE RE-INPUT ":A#(L):GOTO 120
160 NEXT L
170 IF (E(0)>(F(0)PAUSE "INVALID DATA":GOTO 80
180 IF H<0LET I#="":GOTO 210
190 IF H<0LET I#="K":H=H/K:GOTO 210
200 H=H/M:I#="M"
210 PRINT H;" ";I#;" OHMS."
215 GOTO 45
220 INPUT"VALUE:":H:IF (H>=0.1)+(H<=9.9E10)THEN 230
225 BEEP 1:PAUSE"INVALID":GOTO 220
230 FOR J=10TO -1STEP -1
240 IFH>= 10:LET H=H/10:J:GOTO 270
250 NEXT J
270 D#=A#(J+15)
280 C#=A#(H-INT H)*10+16)
290 B#=A#(INT H+16)
300 PRINT B#;" ";C#;" ";D#
310 GOTO 45


PLEASE NOTE: VALUES MAY BE ENTERED IN THE FOLLOWING FORMS:

2200 OHMS CAN BE ENTERED AS a) 2200  or b) 2.2K  BUT NOT 2K2.

4700000 OHMS CAN BE ENTERED AS a) 4700000  or b) 4.7M  BUT NOT 4M7.

THE RANGE OF VALUES IS (WHERE U IS VALUE):  0.1<=U<=99000 MEG OHMS.
```

Resistor converter for Sharp PC-1211 by S Godfrey.

Calculation of inverse Cosh of a complex number.

Let U ± jV = inv cosh (u ± jv)

$$U = \cosh^{-1}\left\{\frac{\sqrt{(1+u)^2+v^2} + \sqrt{(1-u)^2+v^2}}{2}\right\}$$

$$\pm jV = \pm j\cos^{-1}\left\{\frac{\sqrt{(1+u)^2+v^2} - \sqrt{(1-u)^2+v^2}}{2}\right\}$$

Press AC, tap value of u. Press P1/P2 — having loaded program in P1 store. At first ENT display, tap value of v and Run. At second ENT, display the value of u. At final ENT, display the value of v. Press Run to continue as before.

		10.	Kin 1	20.	=	30.	INV HLT
1.	+	11.	ENT	21.	INV v	31.	Kout 1
2.	1	12.	+/−	22.	Kin 2	32.	−
3.	=	13.	+	23.	+	33.	Kout 2
4.	INV x^2	14.	1	24.	Kout 1	34.	=
5.	+	15.	=	25.	=	35.	/
6.	ENT	16.	INV x^2	26.	/	36.	2
7.	INV x^2	17.	+	27.	2	37.	=
8.	=	18.	ENT	28.	=	38.	INV COS
9.	INV v	19.	INV x^2	29.	INV HYP COS		

L Weaver's Bessel functions program.

```
000  76  LBL      007  05   5
001  11   A       008  42  STO
002  42  STO      009  23  23
003  25  25       010  01   1
004  00   0       011  04   4
005  32  X:T      012  42  STO
006  01   1       013  22  22
014  01   1       074  43  RCL
015  03   3       075  10  10
016  42  STO      076  85   +
017  21  21       077  43  RCL
018  01   1       078  08  08
019  42  STO      079  85   +
020  14  14       080  43  RCL
021  65   ×       081  06  06
022  02   2       082  85   +
023  08   8       083  43  RCL
024  55   ÷       084  04  04
025  43  RCL      085  85   +
026  25  25       086  43  RCL
027  54   )       087  02  02
028  42  STO      088  54   )
029  13  13       089  65   ×
030  01   1       090  02   2
031  94  +/-      091  54   )
032  44  SUM      092  44  SUM
033  23  23       093  26  26
034  44  SUM      094  92  RTN
035  22  22       095  76  LBL
036  44  SUM      096  12   B
037  21  21       097  42  STO
038  73  RC*      098  27  27
039  22  22       099  04   4
040  65   ×       100  04   4
041  02   2       101  69  OP
042  65   ×       102  04  04
043  43  RCL      103  43  RCL
044  22  22       104  25  25
045  55   ÷       105  69  OP
046  43  RCL      106  06  06
047  25  25       107  00   0
048  54   )       108  01   1
049  75   -       109  03   3
050  73  RC*      110  05   5
051  23  23       111  01   1
052  54   )       112  06   6
053  72  ST*      113  03   3
054  21  21       114  05   5
055  43  RCL      115  69  OP
056  21  21       116  04  04
057  67  EQ       117  43  RCL
058  79  x̄        118  27  27
059  61  GTO      119  69  OP
060  00  00       120  06  06
061  30  30       121  73  RC*
062  76  LBL      122  27  27
063  79  x̄        123  55   ÷
064  43  RCL      124  43  RCL
065  00  00       125  26  26
066  42  STO      126  54   )
067  26  26       127  99  PRT
068  43  RCL      128  92  RTN
069  14  14       129  00   0
070  85   +       130  00   0
071  43  RCL      131  00   0
072  12  12       132  00   0
073  85   +       133  00   0
                  134  00   0
```

```
EXAMPLE RUN
PRESS P1
"DISPLAY" DEG
        5
PRESS RUN
"DISPLAY" DEG
        5
PRESS RUN
        RAD
        3
ENTER ANSWER
IF YOU MADE A MISTAKE
PRESS C AND RE-ENTER.
PRESS RUN
```

DISPLAY NOTES:

DEG Indicates your previous answer was correct
SRA Indicates your previous answer was incorrect
RAD Indicates that your score is in the display

Step	Program	Comments
1	P1	Select Program Number
2	MODE 70	
3	INV RAN	Generate random number
4	INV X>K1	
5	Kin X1	
6	INV X≤K1	
7	INV RND	
8	INV HLT	Stop and display number
9	+, −, ×, ÷	Designate type of operations
10	Kin 5	Store pending result
11	1	Reduce counter by 1 and check if 0. If C>O go to step 2 IF C3O continue
12	Kin −2	
13	Kout 2	
14	INV X>O	
15	1	
16	=	Finish off calculation so as not to affect the next one.
17	Kout 3	Reset counter
18	INV X>K2	
19	INV X>K4	Bring score into display register and store in K6 and clear K4 register
20	Kin 6	
21	MODE 5	
22	ENT	Stop to allow user to enter answer. Subtract user answer from calculator total If O continue If not go to step 2.
23	Kin −5	
24	Kout 5	
25	MODE 6	
26	INV X>O	
27	+/−	
28	INV X>O	
29	MODE 4	
30	1	Add 1 to score, if it is less than or equal to memory register go to step 2 if not continue.
31	Kin +6	
32	Kout 6	
33	Kin 4	
34	INV X M	
35	Kin −4	
36	1	Add 1 to counter for next round
37	Kin +2	
38	Kin +3	
39	INV RTN	
	MODE●	

Memories
K1 Maximum number to be displayed by calculator
K2 2 K4 0 K6 0
K3 2 K5 0
M = Number of questions to get right.

P Preece's Casio education program.

VIC-20 and Commodore 64 from Kobra

VIC 20

£144·95
inc VAT – carriage free

Still unbeatable value at this price with a full size keyboard
Backed by Adda's full one year warranty.

Features include: * 5K RAM expandable up to 29K * 8 border colours, 16 screen colours * 8 screen character colours * 3 audible tone generators, each of 3 octaves * a 'white noise' generator * 88 character program line length * 64 ASCII character set * full PET-type graphics character set generated directly from keyboard * 176 × 158 pixels (27,808 in total) maximum resolution * 8 programmable special functions accessed via 4 special function keys.

COMMODORE 64

£343·85
inc VAT – carriage free

The 64K personal computer that outpaces the rest
Backed by Adda's full one year warranty.

Features include: * 64K built in RAM * 40 column colour display – tv interface * Upper and lower case characters and graphics * Sprite graphics on eight levels * Music synthesiser with three voices and nine octave range * 16 colours available simultaneously * 8 bit parallel user port.

PRINTER

£230
inc VAT – carriage free

The VIC Printer – suitable for the Commodore 64 also – will print programs, letters, business data and graphics. It offers high specifications at a competitive price.

Features include: 80 characters per line. Tractor feed dot matrix. 30 characters per second print speed. Full alphanumerics and graphic printing. Double-size character capability. Price includes all cables. Alternative printer **GP100VC** with full-size paper feed **£270.25** inc VAT.

DISK UNIT 1541

£299·95
inc VAT – carriage free

For the VIC-20 and the Commodore 64.
A disk unit transforms your computer into a high-speed system ideal for the more serious programmer or small businessman. It enables you to get the best out of your utility programs.

Features include: 170K bytes capacity. Uses soft-sectored standard 5¼" single density floppy disks. Direct interface to computer. Direct compatibility with Printer. Prices includes all cables.

MEMORY PACKS FOR THE VIC-20
Special plug-in cartridges are available to expand VIC's memory. 3K, 8K and 16K RAM packs plug directly into computer.
16K RAM Memory Pack **£74.95,**
8K RAM Memory Pack **£44.95,**
3K RAM Memory Pack **£29.95**

KOBRA

HOW TO ORDER:

VISIT YOUR LOCAL VIC DEALER

BY MAIL OR PERSONAL CALLERS

By mail – post and packing **FREE**. Make cheques or PO's payable to Kobra Micro Marketing. Send to:

The Vic Centre
154 Victoria Road, Acton
London W3 6UL

Near North Acton tube, just off A40

BY TELEPHONE

Telephone orders 24 hrs a day with Visa, Access, Amex

01-200 0200

SIR Computers Ltd.

Agents for Acorn and Torch Computers

BBC Microcomputers

Model A	£299.00
Model A + 32K RAM	£339.00
Model B	£399.00
Model B + Disc interface	£479.00

BBC Compatible TEAC Disc drives

Single disc drive	£249.00
Dual disc drive	£459.00

Torch Disc unit

This is a complete package including a Z-80 processor, 64K RAM, Dual disc drive and the CP/N operating system – fully compatible with all existing CP/M software. Requires a disc-upgraded BBC Model B.

Torch disc pack	£1,149.00

ACORN COMPUTER

8K ROM + 2K RAM	£149.50
8K ROM + 12K RAM	£179.00
12K ROM + 12K RAM	£199.00
16K ROM + 12K RAM	£229.00
1.8 A Power supply	£8.50
ATOM Disc pack	£345.00

please add £7.50 for interlink delivery of BBC Computers & Disk Drives

All prices are inclusive of VAT

SIR Computers Ltd.
38 Dan-y-Coed Road, Cyncoed, Cardiff
Tel: (0222) 759015

YOUR QUICK-LEARN WAY TO BASIC OR COBOL

IN YOUR OWN HOME, IN YOUR OWN TIME, AT YOUR OWN PACE.

Learn computer programming quickly and easily through the renowned ICS "Open College" system, taking the course at your own pace and in your own time.

Use the famous ICS study texts, backed up by your own expert tutor, and learn computer programming, the proven way, with ICS home study.

Courses:
Introduction to Computer Programming
Programming in BASIC
Programming in COBOL

CACC Approved by CACC — Member of ABCC

ALL DETAILS FREE—SIMPLY RETURN THE COUPON BELOW

Please send me your prospectus on Computer Programming

ICS

Name _____
Address _____

Post to: Dept C349
ICS School of Computer Programming
160 Stewarts Road,
London SW8 4UJ

Div. National Education Corporation

01 622 9911 (all hours)

MEMORY DEVICES FROM:

GCC ELECTRONICS

Tel: 0223 21044 **Telex: 817672**

EPROMS		6500 Family		MEMORIES	
2708	200p	6502	375p	2114LP-2	90p
2716+5V	200p	6520	285p	2114-450	85p
2732	385p	6522	375p	4116-150	90p
2532	365p	6532	520p	4116-200	88p
2764	1200p	6545-1	900p	4816-2+5V	250p
				4164-200	410p
6800 Family		**Z80 Family**		6116-150	350p
6800	270p	CPU	315p	5516-250	635p
6802	325p	ACPU	350p		
6810	110p	CTC	270p		
6809	850p	ACTC	290p		
6850	135p	PIO	340p		
6821	110p	APIO	350p		

We supply 74LS TTLs, CMOS 4000 Diodes. Transistors, etc., etc. All components are guaranteed prime parts, from leading manufacturers.

Orders from Government, Educational and Overseas buyers welcome. Special prices for volume enquiries. Please add £1 post and packing plus VAT at 15%. Minimum order £15.00.

GCC ELECTRONICS
18 CLAYGATE ROAD, CHERRY HINTON
CAMBRIDGE CB1 4JZ
TEL: 0223 210444 **TELEX: 817672**

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Worry maze

Andrew Spencer,
Cape Town,
South Africa.

ZX-81

THE FAST GAME in which the player weaves through a maze to defuse bombs is not only an exciting game, but shows the speed of Poke instead of Print At. It also illustrates a few handy techniques.

The first of these is the use of Boolean algebra to make the decisions in lines 140 and 450. These do away with If-Then lines and thus increase speed.

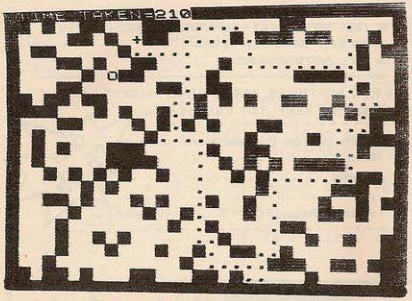
The internal walls of the maze are positioned in lines 230 to 260. The whole screen is used — line 150 — and thus the wall positions must be put within the boundaries. The same goes for the bombs and the player's piece — lines 280 and 330. Lines 290 and 340 check for boxing in of a piece or two pieces in the same place. B$ tells if the bomb arrived at is the correct one. One character in B$ is the bomb and if you reach a dud bomb it is represented by a D.

If you take too long to find the correct bomb you will explode — line 730. The full set of single-space characters is cycled through, alternating between inverse and normal.

A record is kept of the lowest time taken, and this is displayed at the end of each successful game.

The recruit mode allows you to backtrack but if you are not careful you can box yourself in on the "veteran" mode. If this does happen, pressing E will immediately put you out of your misery.

The direction-controlling keys can be changed, if desired, to suit your fingers: lines 450 and 90.




```
  10 REM ■ MAZE OF WORRY ■
         ■ BY A.N. SPENCER ■
         ■ AUGUST 1982 ■
  20 LET DF=PEEK 16396+256*PEEK
16397
  30 LET LSF=1000
  40 DIM B$(5)
  50 LET T=0
  60 CLS
  70 REM ■ INSTRUCTIONS ■
  80 PRINT "WELCOME........",,,,
"    TO THE MAZE OF WORRY"
  90 PRINT AT 4,0;"MOVE YOUR PIE
CE AROUND BY USING THE ""Z"", ""
C"", "".""  AND ""P"" KEYS"
 100 PRINT ,,"YOU MUST TRY TO DE
FUSE THE      CORRECT BOMB BEFOR
E IT BLOWS UP"
 110 PRINT ,,"   YOU ARE A :",,,
,"1: RECRUIT BOMB DISPOSAL OFFIC
ER",,,,"2: VETERAN BOMB DISPOSAL
 OFFICER"
 120 LET A$=INKEY$
 130 IF A$<>"1" AND A$<>"2" THEN
 GOTO 120
 140 LET TRAIL=27*(A$="1")+128*(
A$="2")
 150 POKE 16418,0
 160 FAST
 170 REM ■ PRINT THE MAZE ■
 180 PRINT AT 0,0;"■"
 190 FOR N=1 TO 22
 200 PRINT "■"
 210 NEXT N
 220 PRINT "■"
 230 FOR N=1 TO 225
 240 LET BLOCK=DF+INT (RND*22)*3
3+INT (RND*30)+35
 250 POKE BLOCK,128
 260 NEXT N
 270 REM ■ PLAYER POSITION ■
 280 LET GP=DF+INT (RND*22)*33+I
NT (RND*30)+35
 290 IF PEEK (GP-33)=128 AND PEE
K (GP+33)=128 AND PEEK (GP-1)=12
8 AND PEEK (GP+1)=128 THEN GOTO
280
 300 POKE GP,21
 310 REM ■ BOMB POSITIONS ■
 320 FOR N=1 TO 5
 330 LET BP=DF+INT (RND*22)*33+I
NT (RND*30)+35
 340 IF (BP=GP) OR (PEEK (BP-33)
=128 AND PEEK (BP+33)=128 AND PE
EK (BP-1)=128 AND PEEK (BP+1)=12
8) THEN GOTO 330
 350 POKE BP,52
 360 NEXT N
 370 REM ■ SET "LIVE" BOMB ■
 380 LET B$(INT (RND*5+1))="B"
 390 SLOW
 400 FOR N=1 TO 50
 410 NEXT N
 420 REM ■ MOVE ROUTINE ■
 430 POKE GP,21
 440 IF INKEY$="E" THEN GOTO 740
 450 LET GNP=GP+(INKEY$=".")*33-
(INKEY$="P")*33+(INKEY$="C")-(IN
KEY$="Z")
 460 IF PEEK GNP=128 THEN GOTO 4
30
 470 LET T=T+2
 480 IF PEEK GNP=52 THEN GOTO 53
0
 490 POKE GP,TRAIL
 500 LET GP=GNP
 510 IF T>450 THEN GOTO 730
 520 GOTO 430
 530 REM ■ REACHED A BOMB ■
 540 POKE GP,TRAIL
 550 LET GP=GNP
 560 POKE GP,21
 570 LET P=INT (RND*5+1)
 580 IF B$(P)=" " THEN GOTO 660
 590 IF B$(P)="D" THEN GOTO 570
 600 PRINT AT 0,1;"TIME TAKEN=";
T
 610 IF T<LSF THEN LET LSF=T
 620 PRINT AT 23,1;"LOWEST SO FA
R=";LSF
 630 IF INKEY$<>"" THEN GOTO 630
 640 IF INKEY$="" THEN GOTO 640
 650 GOTO 40
 660 REM ■ DUD BOMB ■
 670 PRINT AT 0,1;"DUD BOMB"
 680 LET B$(P)="D"
 690 FOR N=1 TO 50
 700 NEXT N
 710 PRINT AT 0,1;"        "
 720 GOTO 430
 730 REM ■ TIME UP,EXPLOSION ■
 740 LET N=0
 750 POKE GP,N
 760 LET N=N+129
```

(continued on page 109)

campbell systems

THE VERY BEST IN MACHINE CODE FOR THE **ZXSPECTRUM** & **ZX81**

SPECTRUM 16K **GULPMAN** game of the "....man' variety with 15 mazes, 4 chasers, laser defence, 9 grades, 9 speeds, demo mode, choice of joystick control. "An extraordinarily good program" raves Boris Allan for Popular Computing Weekly. We think you will agree. £5.95

SPECTRUM 48K **MASTERFILE** business/domestic filing and reporting system. So flexible that it is equally usable for your mailing lists, catalogues, stock control, text extracts ..... applications are endless. Fully user-defined data and report display formats, dynamic variable-length file, records and data items. Fully menu-driven with powerful search facilities, sorting, total/average, update, multiple independent files, printing. Yes, we aim to support microdrive when Uncle delivers. Nearly all the 8K we use is machine code, so you get 32K per file. Comes with example file and 22 page manual. £15.00

SPECTRUM 16K **SPDE** Disassembler and Editor, as used by other ZX professionals, and we used it to develop the above. £5.95

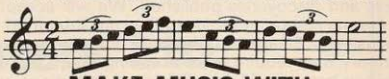
ZX81 16-48K **THE FAST ONE** is the predecessor to MASTERFILE and is in use all over the world now. Specification is very similar to MASTERFILE. £12.00

ZX81 16K **GULP 2** almost identical spec to GULPMAN. £4.75

All programs supplied double-recorded and mailed 1st class by return. Prices include VAT and postage within Europe. SAE for full list.

CAMPBELL SYSTEMS
(Dept. YC)
15 ROUS ROAD
BUCKHURST HILL
ESSEX IG9 6BL
ENGLAND 01-504-0589

16k ZX SPECTRUM



MAKE MUSIC WITH SPECTSOUND

A SOFTWARE PACKAGE WHICH CONVERTS YOUR SPECTRUM INTO A POWERFULL 9 OCTAVE ELECTRONIC ORGAN

INCLUDES:

- SOFTWARE ON CASSETTE
- KEYBOARD OVERLAY SHOWING NEW FUNCTIONS
- AUTO MEMORY & RECALL OF NOTES PLAYED
- FULL 9 OCTAVES AVAILABLE FROM KEYBOARD
- T V DISPLAY OF NOTES PLAYED & BEEP No
- RANDOM MUSIC FACILITY
- FREE BEEP CHART – CONVERTS MUSICAL NOTES TO BEEP Nos & VICE VERSA
- FULL INSTRUCTIONS

To PDQ SOFTWARE, PARSLEY RYE, HILDERS LANE, EDENBRIDGE, KENT. TN8 6JU (p&p free)

Please send me the Spectsound package
Name .....
Address .....
.....
I enclose cheque/PO for £ ..... (inc p&p)

ONLY £5.95

ANIROG Computers

ONE STOP SHOP FOR SOFTWARE AND BOOKS
SPECTRUM — VIC 20 — BBC MICRO — DRAGON 32

Full range of software by leading software houses in the country.
BUG BYTE, QUICK SILVA, RABBIT, AUDIOGENIC, ARCTIC, A.S.K., SILVER SOFT, ROMIC, SOFTWARE FOR ALL, PROGRAMME POWER, LLAMASOFT, SOFTEK, VIDEO SOFTWARE, COMMODORE, DRAGON, and many others.
Huge selection of computer books. Massive stock of books and software. Despatch within 48 hours of receipt of order.
TWO OR MORE ITEMS 7.5% DISCOUNT. 5 ITEMS — £1.00 EXTRA DISCOUNT. ANY MIX OF BOOKS OR SOFTWARE ACCEPTED. VIC 20 — VALUE FOR MONEY SOFTWARE BY ANIROG.
Our packs of seven games contains a balanced mixture of action packed arcade style games, board games and adventure games. All games are in Hi-res Graphics for unexpanded VIC and offer exceptional value for money.
PACK OF SEVEN (VOL 1) — £6.
PACK OF SEVEN (VOL 2) — £6.
TINY TOTS SEVEN — Games for young children. Bright colour graphics and exciting sound effects are special features of these specially written programmes. — **£6.**
CAVERN FIGHTER — Very similar to arcade game 'Scramble'. Four missions to complete, using joystick or keyboard. Solid machine code programme to give all the thrills of arcade game — **£6.**
CRAWLER — All machine code version in the interrupt mode of the arcade game 'Centipede'. Fast and furious — **£6.**

SEND S.A.E. FOR CATALOGUE. PLEASE STATE THE COMPUTER TYPE.

Personal Shoppers Welcome at

CO-OP CRAWLEY

Mail Order
Payment by cheque, P.O. or Visa

Access | BARCLAYCARD VISA

26 Balcombe Gardens, Horley, Surrey. Horley (029 34) 2007/ 6083

Keyboard with Electronics for ZX81

A full-size, full-travel 43-key keyboard that's simple to add to your ZX81 and requires no soldering in the ZX81.

Complete with the electronics to make "Shift Lock", "Function", and "Graphics 2" single key selections making entry far easier.

Powered from ZX81's own standard power supply – with special adaptor supplied.

Two-colour print for key caps.

Amazing low price only **£19.95** incl. VAT and carriage. Order As LW72P

Full details in the June 1982 issue of "Electronics – The Maplin Magazine" on sale at all good newsagents price 60p. In case of difficulty send 60p to address below, or £2.40 for annual subscription (4 issues).

MAPLIN Electronic Supplies Ltd
P.O. Box 3, Rayleigh, Essex SS6 8LR. Tel (0702) 552911

Retail shops at
159 King St., Hammersmith, London W6. Tel 01-748 0926
284 London Road, Westcliff-on-Sea, Essex. Tel (0702) 554000
Lynton Square, Perry Barr, Birmingham. Tel: (021) 356 7292
(Shops closed Mondays). All mail to Rayleigh address.

(continued from page 107)

```
770 IF N>255 THEN LET N=N-256
780 IF N<>62 THEN GOTO 750
790 POKE GP,0
800 PRINT AT 23,0;"YOU HAVE FA
810 GOTO 630
1000 REM  AUTOMATIC RUN
1010 SAVE "MAZE"
1020 RUN
```

Slide show

Stewart Stallworthy,
Rickmansworth,
Hertfordshire.

SPECTRUM

THIS ROUTINE can be used to Poke to the screen any pre-defined picture or pictures. Whilst a Basic program would take approximately 60 seconds, this routine takes less than one second, and can therefore be usefully incorporated in Basic program. First draw a picture on the screen, then save it on tape —

```
SAVE "Picture" SCREEN
10 CLEAR 39997
20 FOR f=40000 TO 40048
30 INPUT a
40 POKE f,a
50 PRINT f,a
60 NEXT f
```

Run the program entering the appropriate decimal codes, and then Save on tape

```
SAVE "Slide" CODE 40000,48
```

The next step is to load the picture bytes into memory. The routine is written to look for them at memory address 40100.

```
CLEAR 39997
LOAD "Slide" CODE 40000,48
LOAD "Picture" CODE 40100,6912
```

Now type

```
RANDOMISE USR 40000
```

and all should be revealed. Each picture takes 6912 bytes, and additional pictures may be located at other memory addresses, for example 47013 and 53926. If these are used, it will be necessary to make the routine look at the correct starting address, and this is done as follows. For picture starting at memory address 47013,

```
POKE 40008,165
POKE 40009,183
```

For picture starting at memory address 53926,

```
POKE 40008,166
POKE 40009,210
```

ADDRESS	MACHINE CODE	MNEMONIC	COMMENT
40000	38	LD H N	
1	28		
2	46	LD L N	6912 into HL
3	1		
4	34	LD(NN)HL	HL into memory
5	62		at 39998 & 39999
6	156		
7	17	LD DE NN	16384 into HL
8	164		
9	156		
40010	33	LD HL NN	16384 into HL
1	0		
2	64		
3	26	LD A (DE)	A=PEEK DE
4	119	LD (HL)A	POKE HL,A
5	35	INC HL	
6	19	INC DE	
7	58	LD A(NN)	A=PEEK 39998
8	62		
9	156		
40020	71	LD B A	B=A
1	61	DEC A	
2	5	DEC B	
3	40	JRZ DIS	Jump to 40030
4	5		if B=0
5	50	LD(NN)A	POKE 39998,A
6	52		
7	156		
8	24	JR DIS	Jump to 40013
9	238		
40030	58	LD A(NN)	A=PEEK 39999
1	63		
2	156		
3	71	LD B A	B=A
4	61	DEC A	
5	5	DEC B	
6	40	JRZ DIS	Jump to 40048 if
7	10		
8	50	LD(NN)A	Poke 39999,A
9	63		
40040	156		
1	62	LD A N	255 into A
2	255		
3	50	LD(NN)A	Poke 39998,A
4	62		
5	156		
6	24	JR DIS	Jump to 40013
7	221		
8	201	RET	Back to Basic

Sounds familiar

David Rees,
Weybridge,
Surrey.

VIC-20

IF YOU HAVE been gazing enviously all year at the BBC's Envelope command and have come home to the flat tones of a Vic-20, this program should cheer you up. It creates sounds at machine-code speed and gives an extra 11 registers for sound control.

Program 1 Pokes the machine code into memory, as the basic Vic has no assembler. Care must be taken when you type in the program, as one error in the code can cause the computer to stay in machine-code mode until you switch it off. The best method for dealing with this is to Save the program before you Run it. Then, if there is a mistake, you can load the program and check it through.

After running program 1, you can New it as the machine code is all that is needed. It is located in the 256 bytes between 7424 and 7679, and the RAMtop has been moved down by this amount so that variables do not erase the program.

To use the command, you must first set the registers. There are 11 registers which have to be Poked to, and program 2 shows a convenient way of doing this.

The registers are as follows:

```
DATA S,FR(1),FR(2),FR(3),T(1),T(2),T(3),
     V(1),V(2),V(3),DT
```

S is the voice chosen, 0 is the low sound, 1 is the medium sound, 2 is the highest sound and 3 is the white noise generator.

FR(1), FR(2) and FR(3) are the numbers that are added to the frequency of the voice chosen each cycle. If the number of the frequency rises above 255, the command wraps it around so that the value becomes 128 plus the value by which it exceeded 255. This means that if you want the command to play several scales of notes there will be no gap in sound once the top of the scale is reached. The number that can be stored in these registers lies between 0 and 255.

T(1), T(2) and T(3) are the number of cycles through which the registers of each of the three parts are added to the sound and volume chosen. Again, the range of values lies between 0 and 255.

V(1), V(2) and V(3) are the numbers which change the volume of the sound each cycle. If 16 is Poked in here, volume does not change. A number lower than 16 lowers the volume, and a number greater than 16 raises it. The effective number can be calculated using 16–V(n).

DT is the delay time after each cycle is completed and can be between 0 and 255, with 0 having a delay time of 0.1ms. and the other numbers are measured in the computer in increments of 0.5ms.

If this seems complicated, program 3 gives the Basic equivalent of the main routine. You

(continued on next page)

(continued from previous page)

can also use this routine to demonstrate how much faster machine code is compared with Basic. Now all you have to do is type in SYS 7424 and the command will start. The registers will not change so SYS 7424 can be used anywhere and as many times as you want in a program. Registers can also be Poked individually so you can change a sound quickly.

You are now ready to create your own sound effects. The main advantage of this command is its speed. Basic cannot run faster than when 30 is Poked into the DT register. Lower numbers down to 5 can create fast, smooth sounds. When DT is 4 or less, sounds merge. These speeds are the most useful as you can mix tones and volume to create your own wave forms.

```
5 REM****PROGRAM 1****
10 POKE 51,255:POKE 52,28:POKE 55,255:POKE 56,28
20 FOR N=0 TO 152
30 READ A
40 POKE 7424+N,A
50 NEXT
60 DATA 24,173,252,29,41,31,141,252,29
70 DATA 173,253,29,41,31,141,253,29
80 DATA 173,254,29,41,31,141,254,29
90 DATA 173,245,29,41,3,141,245,29
100 DATA 169,10,133,1,169,144,133,2,169,0
110 DATA 141,241,29,141,242,29,169,246
120 DATA 133,251,169,29,133,252
130 DATA 172,245,29,177,1,172,241,29,24,113,251
140 DATA 144,3,24,105,128,24,172,245,29
150 DATA 145,1,172,241,29,200,200,200
160 DATA 238,242,29,200,200,200,177,251
170 DATA 24,109,14,144,233,15,24,184
180 DATA 141,14,144,172,255,29,192,0,240,8
190 DATA 162,120,202,208,253,136,208,248
200 DATA 172,241,29,200,200,200,177,251
210 DATA 205,242,29,208,181,238,241,29
220 DATA 169,3,205,241,29,208,6,169,0
230 DATA 141,241,29,96,169,0,76,46,29

999 REM****PROGRAM 2****
1000 FOR N = 0 TO 10:READ A:POKE 7669+N,A:NEXT N
1010 DATA 2,2,0,191,1,211,224,30,16,24,2
1020 SYS 7424:POKE 36876,0

99 REM****PROGRAM 3****
100 FOR A = 1 TO 3
110 FOR B = 1 TO T(A)
120 F = PEEK(36874 + S)+FR(A)
130 POKE 36874+S,(F AND 127)+128
140 V=PEEK(36878)-16+V(A)
150 POKE 36878,V AND 255
160 FOR T=0 TO DT:NEXT
170 NEXT
180 NEXT
```

TABLE 1

Position	Variable	range	function
7669	S	0-3	Voice choice(36874+S)
7670	FR(1)		Frequency + FR(n)
7671	FR(2)	0-255	each cycle
7672	FR(3)		
7673	T(1)		Number
7674	T(2)	0-255	of
7675	T(3)		cycles
7676	V(1)		Volume-16+V(n)
7677	V(2)	0-31	each
7678	V(3)		cycle
7679	DT	0-255	Delay time each cycle

EXAMPLES:

```
Helicopter
1010 DATA 0,2,4,1,8,8,200,30,15,15,1
1020 FOR N=0 TO 70:POKE 36874,240-N:SYS 7424:
NEXT:POKE 36874,0

Laser Gun
1010 DATA 2,2,4,1,8,8,200,30,16,0,2
1020 POKE 36876,99:POKE 36878,15:SYS 7424

Footsteps(walking)
1010 DATA 2,6,0,0,8,8,200,18,16,16,2
1020 POKE 36878,0:FOR N=0 to 10:SYS 7424:NEXT
For running,use 1 as last number in data

Echo
1010 DATA 2,0,127,1,0,8,9,16,16,16,0
1020 FOR N=0 to 9:POKE 36876,225
1030 FOR A=0 to 28:SYS 7424
1040 NEXT A,N
```

Field-gun

B Pearce,
Bath,
Avon.

BBC

THIS PROGRAM has been written for the BBC Model A Micro and uses almost all the available memory. Although it uses procedures which are, I believe, peculiar to the BBC Micro, there is no reason why it should not be adapted for Basic on other micros.

The game is for two players. There are two horizontal blocks representing a plain and a plateau, separated by mountains. The form of the mountains and the height of the plateau are both random, and the plateau may be right or left of the screen. Sited at a random position on the plain is a gun position, and another on the plateau. At the top of the screen a cross wind is specified, random left or right, random strength five to 40 mph in steps of 5 mph.

Player to start is specified, random left or right. The player is required to enter the gun elevation angle, which will be any angle between one to 90°, followed by muzzle velocity — any number from 1 to 20. On the second Return his gun fires a shell along the correct trajectory taking account of the effect of the wind. Each player fires in turn until one hits the others gun, when there is a flash and a bang. During the exchange, previous elevation and velocity settings are listed at each side of the screen for reference.

```
>L.L.
  10REM "FIELD-GUN" by B.Pearce
  20ATV255,1
  30CLEAR:CLS:MODE4:VDU19,1,3;0;:DIMA(4):A%=32+4*RND(96):B%=832+4*RND(96):C%=256+4*RND(32)
  40G%=INT(16*(RND(1)-0.5))*5:IFG%=0THEN40
  50E%=2:F%=2:G%=RND(2):H%=1:I%=SGN(RND(1)-0.5):IFI%=1THEN80
  60PROCFLAT(0,96,128,448):PROCSLOPE(448,1,832):PROCFLAT(832,96,C%,1280)
  70MOVEA%,128:PROCFORT:MOVEB%,C%:PROCFORT:GOTO100
  80PROCFLAT(1280,96,128,832):PROCSLOPE(832,-1,448):PROCFLAT(448,96,C%,0)
  90MOVEA%,C%:PROCFORT:MOVEB%,128:PROCFORT
  100PRINTTAB(1,1);"E  V":PRINTTAB(33,1);"E  V":IFG%>1THEN120
  110PRINTTAB(12,1);"<- Wind ";-1*G%;" mph":GOTO130
  120PRINTTAB(12,1);"Wind ";G%;" mph ->"
  130G%=3-G%:IFG%=2THEN150
  140E%=E%+1:GOTO160
  150F%=F%+1
  160H%=H%+1:IFH%=2THEN170ELSE180
  170IFG%=2THENPRINTTAB(35,10);"RIGHT";TAB(35,11);"FIRES";TAB(35,12);"FIRST"ELSEPRINTTAB(0,10);"
LEFT""FIRES""FIRST"
  180IFH%=3THENPRINTTAB(0,10);"                                                    "
  190INPUTTAB(8,4)"Elevation (1-90) = "J%:IFJ%<10RJ%>90THEN190
  200IFG%=2THEN220
  210PRINTTAB(0,E%);J%:GOTO230
  220PRINTTAB(32,F%);J%
  230PRINTTAB(8,4);"                                    "
  240INPUTTAB(8,8)"Velocity  (1-20) = "K:IFK<10RK>20THEN240
  250IFG%=2THEN270
  260PRINTTAB(3,E%);K:GOTO280
  270PRINTTAB(35,F%);K
  280PRINTTAB(8,8);"                                    "
  290IFG%=2THEN330
  300IFI%=1THEN320
  310MOVEA%,128:PROCSHOT(1,A%,128)
  320MOVEA%,C%:PROCSHOT(1,A%,C%)
  330IFI%=1THEN350
  340MOVEB%,C%:PROCSHOT(-1,B%,C%)
  350MOVEB%,128:PROCSHOT(-1,B%,128)
  360IFG%=2THEN380
  370IFA%>B%-16ANDA%<B%+16THEN390ELSE130
  380IFA%>A%-16ANDA%<A%+16THEN390ELSE130
  390PROCSOUND:PROCBANG:TIME=0:REPEAT:UNTILTIME=200:PRINTTAB(4,30);"Press SPACE BAR for another
game":c=GET:IFc=32THEN30
  400DEFPROCFLAT(K,L,M,N):MOVEK,L:PLOT5,K,M:PLOT85,N,L:PLOT85,N,M:ENDPROC
  410DEFPROCSLOPE(O,P,Q):FORR=1TO5:SX=O+64*P*R:TX=128+(C%-128)*R/5+(RND(128)-64)*R/2:PLOT85,SX,9
```

```
6:PLOT85,S%,T%:NEXT:PLOT85,0,96:PLOT85,0,C%:ENDPROC
  420DEFPROCFORT:PLOT65,-16,0:PLOT65,8,16:PLOT81,8,-16:ENDPROC
  430DEFPROCSHOT(U,V,W):X=6*COS(RAD(J%))*K:Y=6*SIN(RAD(J%))*K:Z=1:REPEAT:a%=U*X*Z+D%*Z^2/100+V:b
%=Y*Z-Z^2/0.48+W:A1(2)=A1(1):A1(1)=a%:A1(4)=A1(3):A1(3)=b%:IFPOINT(a%,b%)<>0ANDb%<512THEN360
  440PLOT69,a%,b%:PLOT71,A1(2),A1(4):Z=Z+0.5:UNTILb%<120:ENDPROC
  450DEFPROCBANG:PLOT1,-64,64:PLOT81,48,-32:PLOT1,-8,32:PLOT81,24,-32:PLOT1,32,96:PLOT81,-8,-64:
PLOT1,24,8:PLOT81,-48,-72:ENDPROC
  460DEFPROCSOUND:SOUND0,1,6,60:ENVELOPE1,5,0,0,0,0,0,0,30,-2,-5,-5,120,80:ENDPROC
>VDU1
```

Acorn pilot

Roy Pincott,
Mansfield,
Nottinghamshire.

ATOM

THIS FLIGHT simulation program, written for the Acorn Atom, gives you a pilot's eye view of aerobatic manoeuvres.

Use this Basic program to learn to fly the plane as though you were sitting inside it. The program has the facility to enable the user to perform victory rolls, loop the loop and fly upside down. A word of advice. It is necessary to remember which direction you are flying — towards or away from the screen — as this has a fundamental effect on the way the plane banks.

```
 10GOS.1000
 15DIMR(7)
 22G=£1740
 25S=£8000
100CLEAR4
101H=17;GOS.144
104GOS.a
120IF H=1;GOS.c;G=G-£100;GOS.2010
121IF H=2;GOS.c;GOS.2020
122IF H=3;GOS.c;G=G-£100;GOS.2030
123IF H=5;GOS.c;G=G-£100;GOS.2050
124IF H=6;GOS.c;GOS.2060
125IF H=7;GOS.c;G=G-£100;GOS.2070
128IF H=20;GOS.c;GOS.2200
129IF H=24;GOS.c;GOS.2240
130IF H=4;GOS.c;G=G-£200;GOS.2040
132IF H=8;GOS.c;G=G-£200;GOS.2080
134IF H=18;GOS.c;G=G-£200;GOS.2180
136IF H=22;GOS.c;G=G-£200;GOS.2220
140IF H=10;GOS.c;G=G+£1;GOS.2100
142IF H=14;GOS.c;G=G+£1;GOS.2140
144IF H=17;GOS.c;G=G-£FF;GOS.2170
146IF H=23;GOS.c;G=G-£FF;GOS.2230
150IF H=12;GOS.c;G=G-£1;GOS.2120
152IF H=16;GOS.c;G=G-£1;GOS.2160
154IF H=19;GOS.c;G=G-£101;GOS.2190
156IF H=21;GOS.c;G=G-£101;GOS.2210
160IF H=9;GOS.c;G=G+£20;GOS.2090
162IF H=11;GOS.c;G=G+£20;GOS.2110
164IF H=13;GOS.c;G=G+£20;GOS.2130
166IF H=15;GOS.c;G=G+£20;GOS.2150
295IF S+G<£8000;G.m
296IF S+G>£98FF;G.m
300F.B=1TO5;?£B000=?£B000 &£F0 +B
310B?£7F=?£B001 &8;N.B
330IF ?£81=0;GOS.d
340IF ?£82=0;GOS.e
350IF ?£83=0;GOS.f
360IF ?£84=0;GOS.g
9996.120
1000CLEAR0
1010P.$12''
1020P."        pilot      """"    BY roy pincott"""
1100P."C BANK LEFT      B BANK RIGHT"""
1110P."E NOSE DOWN      D NOSE UP""""
1200LINK £FFE3
1999R.
2010GOS.c;!R=£18E70000;R!4=£000000;H=1;GOS.a;R.
2020GOS.c;!R=£003C7EC3;R!4=£000018;H=2;GOS.a;R.
2030GOS.c;!R=£E7180000;R!4=£000000;H=3;GOS.a;R.
2040GOS.c;!R=£7E3C0018;R!4=£0000C3;H=4;GOS.a;R.
2050GOS.c;!R=£18E70000;R!4=£000000;H=5;GOS.a;R.
2060GOS.c;!R=£003C7EC3;R!4=£000018;H=6;GOS.a;R.
2070GOS.c;!R=£E7180000;R!4=£000000;H=7;GOS.a;R.
2080GOS.c;!R=£7E3C0018;R!4=£0000C3;H=8;GOS.a;R.
2090GOS.c;!R=£18040606;R!4=£060604;H=9;GOS.a;R.
2100GOS.c;!R=£7B7B70E0;R!4=£00E070;H=10;GOS.a;R.
2110GOS.c;!R=£06081818;R!4=£181808;H=11;GOS.a;R.
2120GOS.c;!R=£DEDE0E07;R!4=£00070E;H=12;GOS.a;R.
2130GOS.c;!R=£18040606;R!4=£060604;H=13;GOS.a;R.
2140GOS.c;!R=£7B7B70E0;R!4=£00E070;H=14;GOS.a;R.
2150GOS.c;!R=£06081818;R!4=£181808;H=15;GOS.a;R.
2160GOS.c;!R=£DEDE0E07;R!4=£00070E;H=16;GOS.a;R.
2170GOS.c;!R=£7B60C000;R!4=£000000;H=17;GOS.a;R.
2180GOS.c;!R=£18180018;R!4=£605838;H=18;GOS.a;R.
2190GOS.c;!R=£0306DE00;R!4=£000000;H=19;GOS.a;R.
2200GOS.c;!R=£181C1A06;R!4=£180018;H=20;GOS.a;R.
2210GOS.c;!R=£DE060300;R!4=£000000;H=21;GOS.a;R.
2220GOS.c;!R=£18180018;R!4=£061A1C;H=22;GOS.a;R.
2230GOS.c;!R=£C0607B00;R!4=£000000;H=23;GOS.a;R.
2240GOS.c;!R=£18385860;R!4=£180018;H=24;GOS.a;R.
```

(continued on page 113)

In stock now at Twickenham's official BBC/Acorn dealer & service centre

Phone for latest prices! 01-891 1612

BBC Model A & B

plus all the extras:

Printers + Monitors + Disk Drives + Cassette Drives + Software + Books

PLUS VIC-20 Cassette decks, games cartridges, & tapes in stock!

Always available – a wide range of micros, software, printers, peripherals and books – send SAE for latest lists

TWICKENHAM COMPUTER CENTRE LTD

72 Heath Rd Twickenham Middx TW1 4BW (01-892 7896/01-891 1612)

TAURUS COMPUTER DESIGN

Our product range for the ZX81 is as follows:

TAURUS 8K PROMCARD
- Fills memory space 8K-16K
- Housed within ZX81 case—easy installation
- Link selectable: 7K PROM+1K RAM or 8K PROM (2×2732)
- Ideal home for TAURUS SOLID SOFTWARE©

TAURUS 16K RAMPACK
- User switchable : Model A 16K RAM or 14K RAM+2K PROM (2716)
  : Model B 16K RAM or 12K RAM+4K PROM (2732)
- Flexible connection to ZX81—eliminates memory wipeout
- Rugged construction—proven high quality design
- Ideal home for TAURUS SOLID SOFTWARE©

TAURUS MACHINE-CODE MONITOR

Version 1:
- 16 user utility commands
- Optimised for developing and testing machine code
- Available as TAURUS SOLID SOFTWARE© on all TAURUS hardware products
- Also available on cassette

Version 2:
- As Version 1+MACHINE CODE DISASSEMBLER
- Displays address, hex instruction bytes, source code
- Standard X-80© mnemonics
- Relative jumps shown with absolute addresses
- Also available on cassette

GRAPHICS EDITOR
- Make your own character shapes—whatever you want!
- Includes routine for switching character sets
- Two new character sets provided (including lower case)
- Available as TAURUS SOLID SOFTWARE©

MACHINE-CODE ASSEMBLER
- Standard Z-80© mnemonics
- Optimised for ZX81 keyboard layout
- Up to 256 user-definable labels
- Available as TAURUS SOLID SOFTWARE©
- Also available on cassette

PRODUCT SUMMARY

	16K RAMPACK Model A/ Model B	8K PROMCARD	Cassette
(Hardware only)	£38.00 / £38.00	£25	—
MONITOR Version 1	£45.00 / —	£8 per EPROM	£7.50
MONITOR Version 2	— / £49.00	£9 per EPROM	£8.50
ASSEMBLER	— / —	£12 per EPROM	£8.50
GRAPHICS EDITOR	— / —	£9 per EPROM	—

Send for details or cheque with order to:
TAURUS COMPUTER DESIGN
47 High Street, Baldock, Hertfordshire SG7 6BG
Telephone Baldock (0462) 893900

PRICE BREAK-THROUGH ON EXTRA MEMORY FOR ZX81 !

The **NEW** EconoTech 16K RAM PACK

adds 16-times more memory to your ZX81 at a budget price!

Fully assembled, tested and guaranteed - neat and compact. fits snugly to eliminate wobble. Compatable with ZX Printer.

ONLY £19.95 !

plus £1.50 post & packing to anywhere in the world

Full refund if not fully satisfied - simply return within 14 days of purchase. Allow up to 28 days for delivery. Fill in the coupon below and send with cheque or P.O.

To:
EconoTech, 30 Brockenhurst Way, London SW16 4UD
Please send me .... 16K RAM Packs @ £19.95 each, plus £1.50 post and packing.

Name .....

Address .....

.....

.....

SPECTRUM

24 LINE INPUT/OUTPUT PORT (motherboard not required)	£18.95
MOTHERBOARD — SIX SLOTS	£26.50
MOTHERBOARD PCB SLOTS	£ 6.50
SPECTRUM 28 WAY CONNECTOR	£ 3.25
MALE CONNECTOR	£ 1.90
34 WAY RIBBON CABLE per metre	£ 1.80

ZX81

40 KEY KEYBOARD	£20.00
SPARE KEYS each	£ 0.25
MOTHERBOARD — TWO SLOTS	£15.00
24 LINE INPUT/OUTPUT PORT	£18.95
16K RAM PACK	£25.00
MOSAIC BOARD	£18.95
23 WAY FEMALE CONNECTOR	£ 2.50
MALE CONNECTOR	£ 1.60
24 WAY RIBBON CABLE per metre	£ 1.40
GETTING ACQUAINTED WITH YOUR ZX81	£ 4.95
PROGRAMMING FOR REAL APPLICATIONS	£ 6.95
REAL APPLICATIONS TAPE	£11.44
MASTERING MACHINE CODE	£ 7.50

Prices are for built items. Postage 40p under £4.00. Export postage (surface) £1.80. Send SAE for full catalogue.

REDDITCH ELECTRONICS

21 FERNEY HILL AVENUE, REDDITCH WORCS B97 4RU

(continued from page 111)

```
4000dIF H=1;GOS.2020;R.
4002IF H=2;GOS.2030;R.
4004IF H=3;GOS.2040;R.
4006IF H=4;GOS.2010;R.
4008IF H=5;GOS.2060;R.
4010IF H=6;GOS.2070;R.
4012IF H=7;GOS.2080;R.
4014IF H=8;GOS.2050;R.
4016IF H=9;GOS.2120;R.
4018IF H=10;GOS.2090;R.
4020IF H=11;GOS.2100;R.
4022IF H=12;GOS.2110;R.
4023IF H=13;GOS.2160;R.
4024IF H=14;GOS.2130;R.
4026IF H=15;GOS.2140;R.
4027IF H=16;GOS.2150;R.
4028IF H=17;G=G-£100;GOS.2200;R.
4030IF H=18;GOS.2170;R.
4032IF H=19;GOS.2180;R.
4034IF H=20;GOS.2190;R.
4036IF H=21;GOS.2240;R.
4038IF H=22;GOS.2210;R.
4040IF H=23;GOS.2220;R.
4042IF H=24;GOS.2230;R.
4050R.
5000eIF H=1;GOS.2040;R.
5002IF H=2;GOS.2010;R.
5004IF H=3;GOS.2020;R.
5006IF H=4;GOS.2030;R.
5008IF H=5;GOS.2080;R.
5010IF H=6;GOS.2050;R.
5012IF H=7;GOS.2060;R.
5014IF H=8;GOS.2070;R.
5016IF H=9;GOS.2100;R.
5018IF H=10;GOS.2110;R.
5020IF H=11;GOS.2120;R.
5022IF H=12;GOS.2090;R.
5023IF H=13;GOS.2140;R.
5024IF H=14;GOS.2150;R.
5026IF H=15;GOS.2160;R.
5027IF H=16;GOS.2130;R.
5028IF H=17;G=G-£100;GOS.2180;R.
5030IF H=18;GOS.2190;R.
5032IF H=19;GOS.2200;R.
5034IF H=20;GOS.2170;R.
5036IF H=21;GOS.2220;R.
5038IF H=22;GOS.2230;R.
5040IF H=23;GOS.2240;R.
5042IF H=24;GOS.2210;R.
5050R.
6000fIF H=1;GOS.2150;R.
6002IF H=2;GOS.2240;R.
6004IF H=3;GOS.2110;R.
6006IF H=4;GOS.c;G=G-£200;GOS.2180;R.
6008IF H=5;GOS.2130;R.
6010IF H=6;GOS.2200;R.
6012IF H=7;GOS.2090;R.
6014IF H=8;GOS.c;G=G-£200;GOS.2220;R.
6016IF H=9;GOS.2010;R.
6018IF H=10;GOS.2170;R.
6020IF H=11;GOS.2050;R.
6022IF H=12;GOS.2210;R.
6023IF H=13;GOS.2030;R.
6024IF H=14;GOS.2230;R.
6026IF H=15;GOS.2070;R.
6027IF H=16;GOS.2190;R.
6028IF H=17;GOS.2140;R.
6030IF H=18;GOS.c;G=G-£200;GOS.2080;R.
6032IF H=19;GOS.2120;R.
6034IF H=20;GOS.2020;R.
6036IF H=21;GOS.2160;R.
6038IF H=22;GOS.c;G=G-£200;GOS.2040;R.
6040IF H=23;GOS.2100;R.
6042IF H=24;GOS.2060;R.
6050R.
7000gIF H=1;GOS.2090;R.
7002IF H=2;GOS.2200;R.
7004IF H=3;GOS.2130;R.
7006IF H=4;GOS.c;G=G-£200;GOS.2220;R.
7008IF H=5;GOS.2110;R.
7010IF H=6;GOS.2240;R.
7012IF H=7;GOS.2150;R.
7014IF H=8;GOS.c;G=G-£200;GOS.2180;R.
7016IF H=9;GOS.2070;R.
7018IF H=10;GOS.2230;R.
7020IF H=11;GOS.2030;R.
7022IF H=12;GOS.2190;R.
7023IF H=13;GOS.2050;R.
7024IF H=14;GOS.2170;R.
7026IF H=15;GOS.2010;R.
7027IF H=16;GOS.2210;R.
7028IF H=17;GOS.2100;R.
7030IF H=18;GOS.c;G=G-£200;GOS.2040;R.
7032IF H=19;GOS.2160;R.
7034IF H=20;GOS.2060;R.
7036IF H=21;GOS.2120;R.
7038IF H=22;GOS.c;G=G-£200;GOS.2080;R.
7040IF H=23;GOS.2140;R.
7042IF H=24;GOS.2020;R.
8000aF.V=0T07;S?G=R?V;G=G+32;N.V;R.
8010bF.V=0T07;S?H=R?V;H=H+32;N.V;R.
8100c!R=£00000000;R!4=£000000;H=G-£120;GOS.b
8110R.
8200aCLEAR0;P.$12;P."you crashed"
9999LINK £FFE3;G.15
```

Accelerator

Bob Boffin,
Woking,
Surrey.

DRAGON

DRAGON OWNERS may be interested in this simple way to speed up their Basic programs.

The technique uses the ability of the Motorola 6809E microprocessor to run in three different modes. The first mode uses a clock rate of 0.9 MHz and is the one used by the Dragon by default. The second mode uses a clock rate of 1.8 MHz but the processor does not output addresses for the video chip so no display is produced, hence this mode is not very useful. It is the third mode which is of interest. In this mode the processor runs at either 0.9 MHz or 1.8 MHz, depending on the address being accessed. Addresses in the range 0000-7FFF hexadecimal or FF00-FF1F hexadecimal are accessed at 0.9 MHz. All other addresses are accessed at 1.8 MHz.

Since the Basic interpreter is located starting at address 8000 hex, if dual rate is selected it will run at 1.8 MHz except when it is accessing RAM. This gives a very significant improvement in Basic performance.

Selection of the processor mode is simple.

```
POKE &HFFD7,0   will switch dual rate on
POKE &HFFD6,0   will switch dual rate off
```

Pressing the Reset button on the side of the Dragon will also Reset the processor mode to normal. Any value may be Poked. It is the act of writing to the location which toggles the switch. If you Peek at these locations they always return the same result.

When you try this on your Dragon the first thing you will notice is that the cursor blinks very much faster. This is an easy way to tell which mode you are in.

A few simple benchmarks will show that the Dragon is now running appreciably faster. The biggest improvement will be found in number-crunching programs where most of the accesses will be at the faster rate. These can show up to 70 percent improvement.

There are some side-effects to using the dual rate. The notes produced by the Sound command will be about an octave higher. Do not use CLoad, CSave or any commands which use the cassette interface while in dual rate as the port address used is accessed at the higher rate. You can switch between the two rates within your Basic program if necessary.

Array sort

Alan Stevens,
Alvaston,
Derbyshire.

MZ-80K

THIS BASIC listing of the Quicksort algorithm is for sorting an array, A(x), of elements, x, into order. The first part of the program simply generates 100 random numbers for the sort routine to work on. The sort subroutine itself consists of lines 1000-1130.

One of the interesting features of the program is that the sort subroutine calls itself recursively — a feature widely regarded as being not possible in Basic.

Those who believe that recursion is not possible in Basic are perhaps being confused by the fact that Basic does not support local variables — recursion is generally much more useful when local variables are available within the subroutine. The other interesting feature of my program, therefore, is the simulation of local variables by the use of subscripted variables. The subscript, S, is increased by one at each entry to the subroutine, and decreased by one at each exit.

(continued on next page)

(continued from previous page)

The program takes about 17 seconds to sort 100 random numbers, about 13 seconds for 100 numbers in reverse order.

The number of nested subroutines required depends on the ordering of the elements in, and the size of the array. For 100 randomly arranged numbers the average number of nested subroutines is 12 — found from experience, though occasionally, as many as 15 are needed.

The MZ-80K allows 15 nested subroutines, which is why arrays L(S) and HI(S) are Dimensioned as shown in line 20. The program may be simply modified for machines which support M nested subroutines by Dimensioning L(M+1) and HI(M+1).

If 15 (or M) nested subroutines are not sufficient, the following lines may be added to the program to extend its range:

```
105 F=0
165 IF F=1 THEN 100
1005 IF S>15 THEN F=1
1006 IF F=1 THEN 1130
```

These lines effectively reinitialise the sort which restarts with an already partly sorted array.

```
10    REM N=NUMBER of ELEMENTS TO BE SORTED:N=100
20    DIM L(16),HI(16),A(N)
30    REM GENERATE AND PRINT N RANDOM INTEGERS
40    FOR R=1 TO N
50    A(R)=INT(N*RND(1))
60    PRINT A(R);
70    NEXT R
80    PRINT:PRINT
90    REM  SET INITIAL CONDITIONS AND CALL QUICKSORT
100   LO=1:HI(1)=N:S=0
110   GOSUB 1000
120   REM PRINT SORTED ARRAY
130   FOR R=1 TO N
140   PRINT A(R);
150   NEXT R
160   PRINT
170   END
900   REM  QUICKSORT SUBROUTINE
1000  S=S+1
1010  L=LO:H=HI(S)
1020  M=A((L+H)/2)
1030  IF A(L)<M THEN L=L+1:GOTO 1030
1040  IF A(H)>M THEN H=H+1:GOTO 1040
1050  IF L>H THEN 1100
1060  T=A(L):A(L)=A(H):A(H)=T
1070  L=L+1:H=H-1
1080  GOTO 1030
1090  REM SET CONDITIOMNS AND RECALL QUICKSORT IF NECESSARY
1100  L(S)=L
1110  IF LO<H THEN HI(S+1)=H:GOSUB 1000
1120  IF HI(S)>L(S) THEN LO=L(S):HI(S+1)=HI(S):GOSUB 1000
1130  S=S-1:RETURN
```

Blitz

Shingo Sugiura,
Tokyo,
Japan.

BBC

THIS PROGRAM is for the BBC Micro model B. It is similar to the Vic-20 game Blitz, although there are a few extras in this implementation. You are in control of an aeroplane rapidly losing altitude. Below you are skyscrapers which you must bomb and flatten enough to land. It plays a nice little tune when you succeed but when you crash the effect is spectacular. If you find the game too fast or too slow, change the speed value given in line 350.

30	SETS F0 KEY
40~140	DEFINES CHARACTERS
150	SOUND FOR BOMBING
160,170	INSTRUCTIONS
180	DEFINES BOMB$
190~300	SET SCREEN
310	INITIALISE STRINGS AND VARIABLES
320	TESTS FOR SPACE BAR
330	PRINTS AEROPLANE
340	CHECK IF PLANE HAS LANDED
350	SLOW DOWN THE PLANE
360	CHECKS IF PLANE HAS CRASHED
370	CALCULATES PLANE'S NEXT POSITION
380	SEE IF BOMB IS ON THE SCREEN
390	PRINT BOMB
400	SEE IF BOMB HAS HIT BUILDINGS
410	EMPTY KEYBOARD BUFFER
420	GOTO320
430~550	INSTRUCTIONS PROCEDURE
560~600	CRASHING PROCEDURE
610~630	BOMB PROCEDURE
640~660	DESTRUCTING PROCEDURE
670~720	INITIALISING STRINGS AND VARIABLES
730~740	POSITION CALCULATING PROCEDURE
750~790	LAND PROCEDURE
800~870	SMASHING PROCEDURE

```
  10 REM BLITZ
  20 REM (C) SHINGO SUGIURA
  30 *KEY0"RUN1M"
  40 VDU23,224,90,126,90,126,90,126,90,126
  50 VDU23,225,90,126,90,90,126,90,90,126
  60 VDU23,226,102,126,102,126,102,126,102,126
  70 VDU23,227,0,0,24,24,36,126,90,126
  80 VDU23,228,60,60,24,24,60,90,126,90
  90 VDU23,229,24,24,24,24,60,126,102,126
 100 VDU23,230,0,32,112,248,252,127,63,0
 110 VDU23,231,0,0,0,1,241,255,253,1
 120 VDU23,232,126,60,24,60,126,126,60,24
 130 VDU23,233,32,124,254,127,63,31,31,31
 140 VDU23,234,0,8,4,102,249,248,252,252
 150 ENVELOPE1,1,11,-6,1,10,30,60,127,0,0,-127,126,0
 160 MODE7
 170 PROCINSTRUCTIONS
 180 IF DL=1 THEN DESTRUCT$=" "+CHR$(10)+CHR$(8)+" " ELSE DESTRUCT$=" "+CHR$(10
)+CHR$(8)+" "+CHR$(10)+CHR$(8)+" "
 190 MODE2
 200 COLOUR134:CLS
 210 VDU23,10,32;0;0;0;
 220 FOR BUILDX=2 TO 18
 230 COLOUR0
 240 A=RND(3)+223
 250 FOR HEIGHTX=29 TO RND(C*4)+(20-C*2) STEP-1
 260 PRINT TAB(BUILDX,HEIGHTX);CHR$(A)
 270 NEXT HEIGHTX
 280 PRINTTAB(BUILDX,HEIGHTX+1);CHR$(A+3)
 290 SOUND1,-15,RND(200),1
 300 NEXT BUILDX
 310 PROCINIT
 320 FIRE$=INKEY$(0):IF FIRE$=" "THEN PROCBOMB
 330 COLOUR1:PRINTTAB(X,Y);AERO$:SOUND0,-5,100,2
 340 VDU26:IF POINT((X+2)*64+32,(30-Y)*32)=0 AND POINT((X+3)*64+32,(30-Y)*32)=0
AND POINT((X+4)*64+32,(30-Y)*32)=0 THEN PROCLAND
 350 FOR SPEED=1 TO 80:NEXT SPEED
 360 IF POINT((X+4)*64+32,(31-Y)*32)=0 THEN PROCCRASH:PROCDROP
 370 PROCMOVE
 380 IF FIRE=0 THEN 320
 390 COLOUR3:PRINTTAB(XB,YB);BOMB$
 400 YB=YB+1:IF YB>=28 OR POINT(XB*64+32,(30-YB)*32)=0 THEN PROCDESTRUCT ELSE 3
30
 410 *FX15,0
 420 GOTO320
 430 DEFPROCINSTRUCTIONS
 440 PRINTTAB(3,10);CHR$(141);CHR$(132);"BLITZ"
 450 PRINTTAB(3,11);CHR$(141);CHR$(132);"BLITZ"
 460 PRINTTAB(2,13);CHR$(135);"YOU MUST DESTROY THE BUILDINGS FLAT"
 470 PRINTTAB(3,14);CHR$(135);"ENOUGH TO LAND YOUR AEROPLANE"
 480 PRINTTAB(5,18);CHR$(135);"PRESS SPACE BAR TO DROP BOMB"
```

```
490 INPUT"      INPUT DESTRUCT LEVEL(1 TO 2)",DL
500 IF DL<1 OR DL>2 THEN 490
510 INPUT"      INPUT DIFFICULTY LEVEL(1 TO 5)",C
520 IF C<1 OR C>5 THEN 510
530 PRINT TAB(5,21);"PRESS f0 TO RESTART"
540 PRINTTAB(5,22);"PRESS ANY KEY TO START":ST$=GET$
550 ENDPROC
560 DEFPROCCRASH:SOUND0,-15,100,18
570 FOR CRASH=1 TO 10
580 FOR RIGHT=1 TO 10:VDU23;13,RIGHT,0;0;0;:NEXT RIGHT
590 FOR LEFT=10 TO 1 STEP-1:VDU23;13,LEFT,0;0;0;:NEXTLEFT
600 NEXT CRASH:ENDPROC
610 DEFPROCBOMB
620 FIRE=1:XB=X+2:YB=Y:IF XB>=20 THEN PROCDESTRUCT
630 ENDPROC
640 DEFPROCDESTRUCT
650 SOUND1,1,100,2:FIRE=0:PRINTTAB(XB,YB);DESTRUCT$:SOUND0,-5,100,2
660 ENDPROC
670 DEFPROCINIT:X=1:Y=3:FIRE=0
680 BOMB$=" "+CHR$10+CHR$8+CHR$232
690 AERO$=" "+" "+CHR$230+CHR$231
700 DROP$=" "+CHR$10+CHR$8+CHR$233
710 DROPT$=" "+CHR$10+CHR$8+CHR$234
720 ENDPROC
730 DEFPROCMOVE:X=X+1:IF X>=20 THEN X=0:Y=Y+1
740 ENDPROC
750 DEFPROCLAND
760 PRINTTAB(1,2);"WELL DONE":RESTORE780:FOR MUSIC=1 TO 10:READ A,B
770 SOUND2,-10,A,B:NEXTMUSIC:END:ENDPROC
780 DATA129,10,117,5,121,5,129,10,101,10
790 DATA121,5,129,5,137,5,145,5,149,5
800 DEFPROCDROP:XD=X+2:XDT=X+3:YD=Y-2:YDT=Y-2
810 FOR DELAY=1 TO 300:NEXT DELAY
820 YD=YD+1:PRINTTAB(XD,YD);DROP$
830 VDU26
840 IF POINT(XD*64+32,(29-YD)*32)=0 OR YD>=28 THEN 850 ELSE 820
850 YDT=YDT+1:PRINTTAB(XDT,YDT);DROPT$
860 VDU26
870 IF POINT(XDT*64+32,(29-YDT)*32)=0 OR YDT>=28 THEN END ELSE 850:ENDPROC
```

Quick copy

Peter Hintjens,
Edinburgh.

VIC-20

THIS BASIC program will load into a chosen area of memory a routine that, whenever Ctrl P is pressed, will produce a quick copy of the Vic screen.

The machine-code routine becomes part of the system interrupt — IRQ — and is called 60 times a second when it can look at the keyboard and take whatever action is necessary.

Enter, check and Save the program, then Run it. At the start you will be asked where the code should go. Normally this will be at the top of memory, but in some cases, for example when using machine code that needs this area, you will want to specify somewhere else. In the first case the program will lower the memory pointers to protect the code, but if you specify a location you must protect it as necessary. A useful free area of memory is the 3K expansion block, if both a 3K and 8K or 16K expansion are fitted.

As the program loads the machine-code data, you may get a number of error messages of the form

?DATA ERROR IN

showing that that data line has been incorrectly entered. If the check sum at the end of each data line fails to pick up the error, the total count — TT — should catch it. When any data error is found, a flag ER is set and the program continues, perhaps to find more errors. After the load, if ER is set then the run is aborted and the memory pointers restored to their initial value, line 570.

As the program is relocatable, certain values must be altered to suit its start — specifically the start of the IRQ wedge. The screen page is also Poked into the routine so that the code will run in any memory size.

When the data has been loaded and assuming that there have been no errors, you will be told the actual start of the routine. Make a note of this number because to prime the code you must type: SYS, then the start address, then press Return. Pressing Stop/Restore will stop the effect of CtrlP.

You can alter the printing parameters — normally double-width and minimum line feed — by the follwing Pokes:

POKE (START) + 99, 15:
POKE (START) + 176, 15

for single-width printing and

POKE (START) + 161, 15

for normal line feeds, useful when dealing only with screens of text. The machine-code routine will automatically print in upper or lower case as set by the shift keys.

Once you have the program working you may take out the data checks — remove the ninth data byte of each line and change lines as follows. 310 to 460 replaced by:

```
310 FOR J = 0 TO 207
320 READ DA: POKE PO + J, DA
330 NEXT J
```

Lines 540 to 570 would be deleted.

```
10 REM** VIC SCREEN DUMP **
20 REM**      BY        **
30 REM**   P. HINTJENS   **
40 REM
50 REM
60 M1 = PEEK (56): M2 = PEEK (55): REM** INITIAL MEMORY POINTERS
70 REM
80 REM** GET CODE START
90 REM
100 PRINT "ZWHERE SHOULD THE CODE RESIDE ?"
110 PRINT "M1 - TOP-OF-MEMORY"
120 PRINT "M2 - SOMEWHERE ELSE"
130 PRINT "XXCHOICE ?"
140 GET A$:IF A$ = "2" GOTO 240
150 IF A$ <> "1" GOTO 140
160 REM
170 REM** DEALLOCATE TOP OF MEMORY BY 256 BYTES
180 REM
190 PO = 256 * M1 + M2 - 256: POKE 56, M1 - 1: POKE 52, M1 - 1
200 PRINT "J";: GOTO 270
```

(continued on page 117)

ZX SPECTRUM & ZX81 EDUCATIONAL SOFTWARE

Spectrum Junior Education **£5.50**

Use your Spectrum to help your children with their school work. This cassette contains eight attractive, easy-to-use programs for the 7 to 11 age group.

Topics include English comprehension, spellings, homophones, junior science, maths and history.

* Entering your own questions and answers allows you to adapt two of these programs for exercises in any subject area.
* Moving colour graphics and sound are extensively used to improve motivation.
* Use the "draw" program to produce pictures, maps and diagrams.

Suitable for the 16K or 48K Spectrum. Program notes are supplied.

O-Level Chemistry (C1) **£5.50**

This cassette contains four clearly presented revision/tutorial programs. The subject matter has been carefully structured to cover the most important aspects of:

* Elements, compounds and mixtures.
* Structure, bonding and properties.
* Redox, electrolysis and the activity series.
* Acids, bases and salts.

48K Spectrum and 16K ZX81 versions of the cassette are available. Please specify which you require.

Professional Computer Assisted Learning materials from:

CALPAC COMPUTER SOFTWARE
108 Hermitage Woods Crescent, St Johns, Woking, Surrey GU21 1UF.

Overseas orders: £6.50 ($11.60) per cassette; includes AIRMAIL postage.

ZX81 Spectrum
MANAGEMENT GAMES

Dallas — £5

A game of oil exploitation in Texas. Decisions are required on purchasing concessions, the movement and use of drilling rigs, and the building of platforms and pipelines. Can you take-over the Ewing Empire.

Airline — £5

Can you compete with British Airways? You must decide on the number of aircraft to operate, whether to buy or charter, whether to enter into a loan or a fuel contract and the levels of staffing and maintenance. Problems encountered are tax demands, strikes, cancelled flights, hijacks and aircraft crashes.

Autochef — £5

As MD of a Catering Company you must negotiate for leases, decide on menu prices, level of wages, advertising and dividends. Each year you must predict the inflation rate. You are also given options on consignments of wines and food and loan contracts. You will be made to resign if you are not successful. There are 3 levels of difficulty.

Print Shot — £5

You own a small printing company and are required to decide on (a) the number and type of staff you employ and when to increase or reduce staff (b) the amount and type of paper you stock (c) the week in which work is schedules (d) the quotation for each. Are you an entrepreneur? Test your business acumen to the limit! There are 3 levels of difficulty.

Business Model Modeller X £8

This is a very User Friendly business modeller. It does not have the flexibility or the complexity of Micromodeller. However it does provide the managers with a useful business tool and an introduction to modelling. The model shows the profit sensitivity and the interaction of the pertinent marketing and production factors of a business.

All Programs include detailed instructions and need 16K

DISCOUNT: £1.50 for two; £3 for three; £5 for four and £7 for five

C.C.S. **DEPT YC**
CASES COMPUTER SIMULATIONS
14 Langton Way
London SE3 7TL

NEW! from YOUR COMPUTER

As a reader of *Your Computer* you'll agree that every issue is an invaluable reference.

To keep your copies in order you'll need a binder, specially designed for *Your Computer,* to ensure every issue remains in good condition for your future use.

To order your binder complete the coupon below and return it to us, with your cheque. Prices, including VAT, postage and packing, are as follows:

UK	£3.45
Europe	£4.00
Rest of the World	£5.00

To: **General Sales Manager, Room 108, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS, England.**

Please send me.....*Your Computer* binders at £.....each.

I enclose my cheque/postal order for £.....made payable to IPC Business Press Ltd.

Name.....

Address.....

.....

.....

(continued from page 115)

```
210 REM
220 REM** USER CHOOSES LOCATION FOR CODE
230 REM
240 PRINT "%ALLOW 208 BYTES FOR   CODE."
250 INPUT "%START POSITION"; PO: PO = INT (ABS (PO))
260 PRINT "%PLEASE PROTECT MEMORY AS REQUIRED."
270 PRINT "%START OF CODE =" PO
280 REM
290 REM** LOAD CODE INTO 208 BYTE BLOCK STARTING AT 'PO'
300 REM
310 TT = 0: REM** CHECK TOTAL FOR ALL DATA
320 FOR LINE = 0 TO 25: REM** SPLIT DATA INTO LINES FOR CHECKING
330 CS = 0: REM** CHECKSUM FOR DATA LINE
340 FOR J = 0 TO 7: READ DA: CS = CS + DA
350 POKE PO + LI * 8 + J, DA
360 NEXT J: TT = TT + CS
370 CS = CS AND 255: REM** CHECKSUM MOD 256
380 READ DA: TT = TT + DA
390 REM
400 REM** IS THE LINE OKAY?  (LOCATIONS 63-64 HOLD DATA LINE NUMBER)
410 REM
420 IF CS <> DA THEN PRINT "%?DATA ERROR IN"PEEK (63) + 256
    * PEEK (64): ER = 1
430 REM** DON'T STOP AFTER FIRST ERROR BUT SET FLAG 'ER'
440 NEXT LINE
450 IF ER THEN PRINT "%?PROGRAM ABORTED": GOTO 570: REM** ABORT
    AND RESTORE MEMORY
460 IF TT <> 30196 THEN PRINT "%?DATA ERROR, POSITION  UNKNOWN.":
    GOTO 570: REM * ABORT
470 REM** ALTER POSITION-SPECIFIC LOCATIONS
480 POKE PO + 2, (PO + 13) AND 255: REM** NEW IRQ VALUES (LOW)
490 POKE PO + 7, (PO + 13) / 256: REM** (AND HIGH)
500 POKE PO + 84, PEEK (648): REM** SCREEN LOCATION
510 PRINT "%TYPE 'SYS"PO"M' <RET> TO PRIME THE CODE."
520 PRINT "%PRESS CTRL-P ONCE FOR A DUMP AT ANY[illegible] TIME."
530 END: REM** CODE OKAY AND IN MEMORY
540 REM
550 REM** ABORT SEQUENCE - RESTORE MEMORY POINTERS
560 REM
570 POKE 56, M1: POKE 52, M1: POKE 55, M2: POKE 51, M2
580 REM** DATA FOR MACHINE CODE
590 DATA 120, 169, 13, 141, 20, 3, 169, 29, 151
600 DATA 141, 21, 3, 88, 96, 72, 152, 72, 133
610 DATA 138, 72, 165, 197, 197, 253, 240, 13, 251
620 DATA 133, 253, 201, 13, 208, 7, 173, 141, 105
630 DATA 2, 201, 4, 240, 8, 104, 170, 104, 65
640 DATA 168, 104, 76, 191, 234, 120, 169, 0, 38
650 DATA 32, 189, 255, 173, 5, 144, 160, 255, 189
660 DATA 162, 4, 41, 15, 240, 2, 160, 7, 119
670 DATA 169, 4, 32, 186, 255, 32, 192, 255, 101
680 DATA 162, 4, 32, 201, 255, 176, 114, 169, 89
690 DATA 0, 133, 251, 169, 30, 133, 252, 32, 232
700 DATA 237, 255, 134, 1, 134, 0, 132, 2, 127
710 DATA 160, 0, 169, 14, 32, 210, 255, 177, 249
720 DATA 251, 201, 128, 144, 9, 41, 127, 72, 205
730 DATA 169, 18, 32, 210, 255, 104, 201, 34, 255
740 DATA 208, 2, 169, 39, 201, 32, 144, 8, 35
750 DATA 201, 64, 144, 7, 9, 128, 208, 3, 252
760 DATA 24, 105, 64, 32, 210, 255, 169, 146, 237
770 DATA 32, 210, 255, 200, 208, 2, 230, 252, 109
780 DATA 198, 1, 208, 203, 198, 2, 240, 27, 53
790 DATA 169, 8, 32, 210, 255, 169, 13, 32, 120
800 DATA 210, 255, 169, 15, 32, 210, 255, 169, 35
810 DATA 14, 32, 210, 255, 166, 0, 134, 1, 44
820 DATA 24, 144, 172, 169, 13, 32, 210, 255, 251
830 DATA32,231,255,104,170,104,168,104,144
840 DATA 88, 76, 191, 234, 234, 234, 234, 234, 245
```

Graphic aid

John Buchanan,
East Horsley, Surrey.

SPECTRUM

THIS is a machine-code routine to overcome an annoying feature of Sinclair Basic: the CLS command must follow a global Paper Ink, Flash or Bright command or statement. This means that if you have created a screenful of high-resolution graphics and you want to make the whole screen flash or change the Ink or Paper colour over the whole screen, you have to execute a global colour statement then clear your display and then redraw it.

This can be undesirable especially if your display took a long time to draw. The machine-code routine can be called during or after the program execution. The new attributes for the screen are set using the Randomise N sequence where N is chosen, according to page 116 of the manual. Then the routine is executed by a call to 1+RAMtop - this is 32570 on the 16K machine.

```
  10 REM GRAPHICS UTILITY #/c
  20 REM © J.N.Buchanan 1982
  30 REM
  40 CLEAR (PEEK 23730+256*PEEK
23731)-15
  50 LET P=PEEK 23730+256*PEEK 2
3731: FOR F=1 TO 15: READ A: POK
E P+F,A: NEXT F
  60 DATA 62,91,237,75,118,92,33
,0,88,113,35,188,200,24,-6
  70 NEW
```

```
  10 REM Demonstration Progra#
  20 REM
  30 LET A=INT (256*RND)-128
  40 LET B=INT (172*RND)-85
  50 PLOT 128,86: DRAW A,B,PI/2*
RND+0.1
  60 BEEP 0.3,50*RND-25
  70 RANDOMIZE
  80 LET L=USR 32570
  90 PAUSE 45
 100 GO TO 10
```

Function copy

John Crombie,
Lisburn,
County Antrim.

ATOM

THIS SHORT program for the Acorn Atom simulates the function keys of the BBC Micro. The functions to be executed are held in strings and executed by pressing Shift plus the string name so the string will be executed as if

$A = "PRINT""ATOM FUNCTION KEYS"""

typed from the keyboard by typing Shift A. If a carriage return is required at the end of the function a Ctrl A should be substituted in the function string so

$L = "LIST(CTRL A)"

will execute List(CR) every time Shift L is pressed.

Line 130 sets up where the functions are going to be stored: in this case # 8200. Each function string is limited to 63 characters, so total storage for the 26 functions is 1,008 bytes. Line 290 changes the character input vectors. Lines 310-330 dimension the other strings and default them to a single space, while lines 170-265 contain the actual machine-code routine required.

```
10REM*****************************
20REM* ATOM FUNCTION KEYS
30REM*
40REM* (C) J.CROMBIE      1982
50REM*
60REM* FUNCTION KEYS
70REM*   SHIFT A - SHIFT Z
80REM* FUNCTION HELD IN
90REM*          $A - $Z
100REM*****************************
110REM
120REM
130 A=#8200
140 DIM VV6:VV2=#2800:P.$21
150 FOR I=1 TO 2 :P=#2800
160[
170:VV0 JSR#FE94:CMP@#61:BMIVV1:CMP@#7B:BPLVV1
180JSRVV2::VV1RTS
190:VV2SEC:SBC@#61:STY#AD:TAY:STX#AC:LDX#AD
200 LDA#322,Y:STA#AE
210 LDA#33D,Y:STA#AF
220 LDY@0
```

(continued on next page)

(continued from previous page)

```
230:VV3 INY:LDA(#AE),Y:CMP@#D:BEQVV4
240DEY:LDA(#AE),Y:STA#100,X:INX
250INY:JSR#FE52:JMPVV3
260:VV4DEY:LDA(#AE),Y:CMP@1:BNEVV5:LDA@#D
265:VV5 STX#AE:LDY#AE:LDX#AC:RTS
270]
280N.:P.$6
290?#20A=0:?#20B=#28
310FOR @=0 TO 25:@?#322=?#322+@*63
320@?#33D=(?#322+@*63)/256+?#33D
330!(@?#33D*256+@?#322)=#20200D20:N.
340END
```

Screen scroll

Martin Layley,
Wokingham,
Berkshire.

DRAGON

ACCORDING TO the Dragon manual, when using Get and Put to move blocks of graphics, an array has to be Dimensioned to the same size or greater than the area of the graphics block. This is not so. In fact, you can get away with much less space in the array. The manual says that to Get a 20 by 20 block from the screen you need an array of (19,19). But you only need:

(0,100) in modes 3 and 4
(0,50) in modes 1 and 2
(0,25) in mode 0

The reason for this is that each element in an array takes five bytes, and that the computer stores more than one pixel in each byte.

The way of working this out is as follows: first, multiply the horizontal size of the graphics block, by the vertical size, then divide this by five and round up to the next nearest whole number. Next, for modes 3 and 4, divide by eight; for modes 1 and 2, divide by 16; for mode 0 divide by 32. Now round up to the next whole number. Finally, dimension the array with 0 as the first parameter, and the number which you have just arrived at as the second.

```
1 '**SCREEN SCROLLER
2 '
3 '**MARTIN LAYLEY 1982
4 '
5 '**SET GRAPHICS SCREEN
6 PMODE 4:SCREEN 1,1:COLOR 0,5:PCLS
7 '**DIMENSION ARRAYS
8 DIM L(0,76),S(0,1190)
9 '**DRAW ELLIPSE
10 CIRCLE (128,95),128,0,.75
11 'SHIFT SCREEN 10 PIXEL TO THE LEFT
12 GET (0,0)-(9,191),L
13 GET (10,0)-(255,191),S
14 PUT (245,0)-(255,191),L
15 PUT (0,0)-(244,191),S
16 GOTO 12
```

Relocate screen

Paul Dunning,
Bristol,
Avon.

ATARI

THIS PROGRAM demonstrates how it is possible to relocate the screen in any part of memory on the Atari computer. It does this by Poking two addresses near the beginning of the display list with the high and low bytes of the memory location that you wish the screen to be placed at. Unfortunately the position of the display list varies depending on the graphics mode.

If you Peek memory locations 560 and 561 they will give you the high and low bytes of the address of the display list. You then add four to this in order to get the address to Poke the new screen location. Line 10 does this.

The variables are as follows: SP is the location to Poke low byte of screen; SP+1 is the location to Poke high byte of screen.

```
 5 GRAPHICS 7:POKE755,1
 6 ?:?"SMOOTH SCROLLING IN
   GRAPHICS 7"
10 SP=PEEK(560)+PEEK(561)*256+4
12 POKESP,176:POKESP+1,163
20 S=176:H=163
25 GOTO60
30 S=S+40:IFS>255 THEN S=S-256:
   H=H+1
40 POKESP,S:POKESP+1,H
50 RETURN
60 ST=STICK(0)
70 IFST=14 AND H>163 THEN GOSUB100
80 IFST=13 AND H<191 THEN GOSUB30
90 GOTO60
100 S=S-40:IFS<0 THEN S=S+256:H=H-1
110 POKESP,S:POKESP+1,H
120 RETURN
```

Use a joystick in port 1 to scroll the screen up and down memory.

Tight security

Andrew Ho,
Leicester.

ZX-81

IDEAS FOR maintaining program confidentiality have been published before in Basic, requiring the user to input a secret codeword before the program will run. Such security checks are easily bypassed in Basic by the use of Break or Stop keys. This code routine cannot be circumvented. The machine code is stored in a Rem statement containing 50 characters, as the first line of the program. Since many hexadecimal machine-code loading programs have been published, it is not necessary to repeat one here.

The routine starting at 16516 prints a screen prompt, then calls the key-scan subroutine in ROM many thousand times, seeking for a secret combination of keys to be pressed. If this is not found within 27 seconds, it jumps to the New subroutine in ROM and erases the program, thus preventing unauthorised access. To be effective, this idea should be incorporated in a program which auto-runs on loading from cassette.

The line following the program line containing Save should enter the machine-code routine at 16516 immediately, as illustrated in the sample program. The routine will work in both 1K and 16K machines, although it will probably find more use in 16K programs which might store confidential information. The screen is cleared and the counter reset before entry to the main program, so that further copies of the program will still feature this security check.

The secret codeword may be two, three or any number of any keys to be simultaneously pressed, thus making it impossible for uninformed users to breach the security check.

Your own secret codeword can be used if you understand how the key-scan routine operates in ROM. For those who do not, here are some possibilities:

16535	16536	codeword
9D	D9	AHO
7D	F1	ASM
7B	F3	WM
AE	E6	Shift X 7J

Address	Hexa-decimal code	Explanation
16514	FF 63	Set counter
	3E 28 D7	
	3E 34 D7	
	3E 29 D7	Print screen prompt
	3E 2A D7	
	3E 0F D7	
16531 loop	CD BB 02	Call Keyscan
	11 9D D9	LD DE, secret code
	AF	XOR A
	ED 52	SBC HL, DE
	28 0D	JR Z, +13
16542	2A 82 40	LD HL, (16514)
	2B	DEC HL
	22 82 40	LD (16514), HL
	BC	CP H
	20 EB	JR NZ, loop
	C3 C3 03	JP NEW
	CD 2A 0A	Call CLS
	3E 63	LD A, 63 Reset
	32 83 40	LD (16515), A Counter
16563	C9	RET

Andrew Ho's protection program.

```
9000 SAVE "program name"
9010 RAND USR 16516
9020 RUN or GOTO start of program
```

Sample program.

SOFTWARE FILE

Code machine

Kenneth Hart,
New Crofton,
Wakefield.

ZX-81

THIS PROGRAM turns a sentence into a series of blocks of five-figure code.

There are 65,535 different codes available and the code can be a different length to the original message.

I have built into the program a copy routine which is only marginally slower than the inbuilt copy routine.

The advantage is that it only prints one blank line and therefore saves paper.

```
   0REM A  K.HART PROGRAM FOR
      THE 16K. ZX81  22-5-82
      THE CODE MACHINE
  10 PRINT AT 1,7;"THE CODE MACH
INE"
  20 PRINT
  30 PRINT "PLEASE PRESS ""C"" T
O CODE OR",TAB 13;""D"" TO DECO
DE"
  40 LET A$=INKEY$
  50 IF NOT (A$="C" OR A$="D") T
HEN GOTO 40
  60 CLS
  70 PRINT AT 1,3;"PLEASE INPUT
CODE NUMBER";TAB 6;"( 1 TO 65535
)"
  80 INPUT A
  90 IF A<1 OR A>65535 THEN GOTO
80
 100 CLS
 110 RAND A
 120 IF A$="D" THEN GOTO 1000
 130 PRINT AT 1,3;"PLEASE INPUT
YOUR MESSAGE";TAB 7;"( MAX. 14 L
INES )"
 140 INPUT B$
 150 LET B=LEN B$
 160 IF B<452 THEN GOTO 220
 170 PRINT AT 4,3;"THIS MESSAGE
IS TO LONG"
 180 FOR F=1 TO 100
 190 NEXT F
 200 PRINT AT 4,3;"
                    "
 210 GOTO 140
 220 IF B/5<>INT (B/5) THEN LET
B=B+B/5-INT (B/5)
 230 IF B/5<>INT (B/5) THEN GOTO
 150
 240 CLS
 250 PRINT "CODE ";A
 260 PRINT "YOUR MESSAGE IS:-"
 270 PRINT B$
 280 GOSUB 2000
 290 FAST
 300 DIM C$(B)
 310 FOR I=1 TO B
 320 IF B$(I)=" " THEN LET B$(I)
=""
 330 LET C=CODE B$(I)+INT (RND*2
5)
 340 IF C>63 THEN LET C=C-37
 350 LET C$(I)=CHR$ C
 360 NEXT I
 370 LET L=0
 380 PRINT "CODE ";A
 390 PRINT "THE CODE IS:-"
 400 FOR I=1 TO B STEP 5
 410 FOR F=0 TO 4
 420 LET L=L+1
 430 PRINT C$(I+F);
 440 NEXT F
 450 PRINT " ";
 460 IF L/25=INT (L/25) THEN PRI
NT
 470 NEXT I
 480 SLOW
 490 GOSUB 2000
 500 GOTO 1400
1000 PRINT AT 1,1;"PLEASE INPUT
THE CODED MESSAGE
1010 PRINT "( MAX 18 LINES BY 2
5 LETTERS )"
1020 INPUT B$
1030 LET B=LEN B$
1040 IF B<577 THEN GOTO 1100
1050 PRINT AT 4,8;"THIS IS TO LO
NG"
1060 FOR F=1 TO 100
1070 NEXT F
1080 PRINT AT 4,8;"
                    "
1090 GOTO 1020
1100 CLS
1110 PRINT "CODE ";A
1120 PRINT "CODED MESSAGE IS:-"
1130 PRINT B$
1140 GOSUB 2000
1150 FAST
1160 DIM C$(B)
1170 LET C=0
1180 FOR I=1 TO B
1190 IF B$(I)=" " THEN GOTO 1250
1200 LET C=C+1
1210 LET D=CODE B$(I)-INT (RND*2
5)
1220 IF D<27 AND D<>0 THEN LET D
=D+37
1230 LET C$(C)=CHR$ D
1240 IF C$(C)=" " THEN LET C$(C)
=""
1250 NEXT I
1260 CLS
1270 PRINT "CODE ";A
1280 PRINT "THE MESSAGE IS:-"
1290 PRINT C$
1300 SLOW
1310 GOSUB 2000
1400 PRINT "PRESS ANY KEY TO CON
TINUE"
1410 PRINT " OR ""NEWLINE"" TO S
TOP"
1420 LET E=CODE INKEY$
1430 IF E=0 THEN GOTO 1420
1440 CLS
1450 IF E<>118 THEN RUN
1460 STOP
2000 PRINT AT 21,0;" DO YOU WAN
T A COPY (Y OR N)? "
2010 LET G$=INKEY$
2020 IF NOT (G$="Y" OR G$="N") T
HEN GOTO 2010
2030 IF G$="N" THEN GOTO 2160
2040 PRINT AT 21,0;"  I AM MAKI
NG A COPY FOR YOU  "
2050 LET F=0
2060 LET G=PEEK 16396+256*PEEK 1
6397
2070 LET G=G+1
2080 LET H=PEEK G
2090 IF H=118 THEN GOTO 2070
2100 IF H=0 THEN LET F=F+1
2110 IF H<>0 THEN LET F=0
2120 LPRINT CHR$ H;
2130 IF F<3 THEN GOTO 2070
2140 LPRINT
2150 LPRINT "-------------------
-----------"
2160 CLS
2170 RETURN
2200 SAVE "CODE"
2210 RUN
```

Renumbering

G J Cocks,
Great Rollright,
Oxfordshire.

SPECTRUM

HERE IS a renumbering facility for the ZX Spectrum, and it will easily fit into the 16K model. The Basic program loads the machine code above a reset RAMtop, then Saves it on to tape, verifies it, and then clears the Basic program out of the memory.

Whenever you need to renumber, just enter the command:

PRINT USR 32550 : LIST

To load the machine code from tape, just type the command:

CLEAR 32549 : LOAD "renumber" CODE 32550, 40

The machine-code program is listed with comments to help understand how it works.

```
10 CLEAR 32549
20 FOR a = 32550 TO 32589
30 READ n : POKE a,n : a
40 DATA 17,10,00,58,83,92,111,58,84,92,103,24
        14,114,35,115,6,10,19,16,253,35,78,35,
        70,9,35,58,75,92,189,32,236,58,76,92,
        188,32,230,201
50 SAVE "renumber" CODE 32550,40
60 VERIFY "renumber" CODE 32550,40
70 NEW
```

DECIMAL	CODE	MNEMONIC	COMMENTS
17,10,00		Ld DE,10	Load first line no. into DE registers
58,83,92		Ld A,(23635)	Load L.S.B. of address of start into A
111		Ld L,A	Load A into L
58,84,92		Ld A,(23636)	Load M.S.B. of address of start into A
103		Ld H,A	Load A into H
24,14		Jr,14	Jumr to test for end of program
114		Ld (HL),D	Alter M.S.B. of line number
35		Inc HL	Move to L.S.B of line number
115		Ld (HL),E	Alter L.S.B of line number
6,10		Ld B,10	Create next line number
19		Inc DE	By incrementing DE
16,253		Djnz 253	Until B = 0
35		Inc HL	Move to L.S.B. of length
78		Ld C, (HL)	Load L.S.B. of length of line into C
35		Inc HL	Move to M.S.B. of length of line
70		Ld B,(HL)	Load L.S.B. of length of line into B
9		Add HL,Bc	Add length of line to HL
35		Inc HL	Move to start of next line
58,75,92		Ld A,(23627)	Load L.S.B. of address of start of variables into A
189		Cp L	Compare with L
32,236		Jnz 236	Jumr back to alter line number if O.K.,continue if not
58,76,92		Ld A,(23628)	Load M.S.B. of address of start of variables into A
188		Cp H	Compare with H
32,230		Jnz 230	Jumr back to alter line number if O.K.,continue if not
201		Ret	Return to Basic

Speed scroll

Munir Zaman,
Levenshulme,
Manchester.

ZX-81

THIS PROGRAM performs the scroll function at speed without disrupting the display file. ZX-81 users will notice that clearing the screen after a scroll function takes a long time if the program is long; also printing takes a long time after a scroll function.

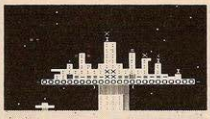
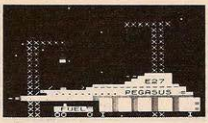
This program does not have these disadvantages, and it only occupies 15 bytes compared to Per Nielsen's program although it does not have the special features. The program can be stored anywhere. If in line 1 — Rem — the program can be called RAND USR 16514. Do not use the program if you have less than 3.25K of memory or if you have used SCROLL. — CLS will negate this.

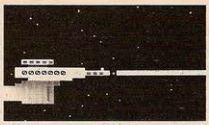
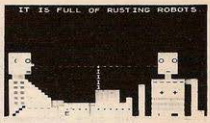
Z-80 assembler	hex	decimal
LD, HL, (16396)	2A, 0C, 40	42, 12, 64
PUSH HL	E5	229
LD DE, 33	11, 21, 00	17, 33, 0
ADD HL, DE	19	25
POP DE	D1	209
LD BC, 726	01, D6, 02	1, 214, 2
LD IR	ED, B0	237, 176
RET	C9	201

The following routine will load the program:

```
10 LET X = 16514 (starting address)
20 INPUT A$
30 POKE X, CODE A$*16 + CODE A$ (2) -476
40 IF A$ = "C9" THEN STOP
50 LET X = X+1
60 GOTO 20
```

■

And now for the big picture.

TRADER A trilogy of 16K programmes that combine to give an epic 48K graphic adventure. As a galactic trader, you deal with some very bizarre customers indeed. Will you live to tell the tale? ZX81 £10.50. VIC20 £18.50 (tape or disc).

SUBSPACE STRIKER Our top selling, big screen graphic game. With your deadly Antimat torpedoes, you unleash havoc in the Federation spacelanes and try to dive back to the safety of subspace, fast. ZX81 £5.50. VIC20 £9.50. 16K.

STARQUEST A voyage of discovery and adventure in the cosmos. With the help of your onboard computer, you seek a habitable planet amidst the perils of deep space. ZX81 £5.50.VIC20 £9.50. 16K.

ENCOUNTER Would you know what to do if you encountered extra-terrestial beings? In this adventure, you are snatched off the Earth and the space invaders play YOU! ZX81 £5.50.VIC20 £9.50. 16K.

ZOR Battle of the robots. Fight for survival in this action-packed strategy game. Megajoules of destructive energy in a futuristic duel. ZX81 £5.50. VIC20. £9.50. 16K.

PIXEL POWER At last it is easy to create your own custom characters on the 8K plus expanded VIC20. A graphics workshop packed with useful features like Create, Amend, Save, View Set. £9.50. Refreshes the pixels that other programmes can't reach. (See Pixel Power in action in Trader and Subspace Striker)

HARVESTER Reap your reward in the Boosterspice fields around the planet Delta. A cut-throat strategy game for 2 to 4 players for the unexpanded VIC20. £4.50.

BRAINSTORM The telepathic emissions of the friendly Psions can wreck a human brain. Can you get our three space explorers across a river of nasty goo without blowing their minds. Unexpanded VIC20. £4.50.

GUITARPIX 1 For the VIC20 owner who wants to play the guitar. The first of a series that shows how to tune the guitar and demonstrates some elementary chords. Unexpanded VIC20. £4.50.

Send SAE for more details.

PIXEL

Pixel Productions 39 Ripley Gdns. London SW14 8HF

TRS 80 GENIE SOFTWARE

Do you own a TRS 80 Model I Level II or Video Genie Micro System? Have you seen my new catalogue of Cassette Software for these machines?

If not, do not miss out. Get my fully descriptive **FREE** catalogue of fairly priced quality software **NOW** by clipping the coupon or writing direct.

SAE not required.

Beginner or expert, something of interest awaits you.

J. K. GOSDEN SOFTWARE
Tineslip, 13 Ashtead Common,
Ashtead, Surrey KT21 2ED.

J. K. GOSDEN SOFTWARE, TINESLIP, 13 ASHTEAD COMMON, ASHTEAD, SURREY KT21 2ED.

Please send me your free catalogue. (Do not send SAE.)

NAME _____

ADDRESS _____

_____

_____

MACHINE _____

MEMORY _____

YC

VIC 20 SPECIAL OFFER

Ten Cassette Programs worth £79.50

ASK FOR SOFTWARE DETAILS

FREE when you buy

VIC 20 COMPUTER at £134.99 AND **VIC 20 CASSETTE UNIT at £40.95**

TOTAL PACKAGE PRICE £175.94 INC. VAT

Please make Cheques/P.O.'s payable to: Kayde Electronic Systems Ltd. Please add £1.50 P&P

KAYDE ELECTRONIC SYSTEMS LIMITED
THE CONGE, GT. YARMOUTH, NORFOLK, NR30 1PJ
TEL: 0493 57867

To: Kayde Electronic Systems Ltd., The Conge, Gt. Yarmouth, Norfolk, NR30 1PJ.

Please supply: 1 VIC 20 computer at £134.99, 1 VIC 20 cassette unit at £40.95. Total price of £175.94 plus my 10 free cassettes.

Name .....

Address .....

.....

COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in January. The name of the winner, the solution, and a competition report will be published in the March, 1983 issue of *Your Computer*.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

Competition results

THE PRIZE for the November competition was a Jupiter Ace, currently unique among micros in having Forth rather than Basic as its resident language. No less than 128 people hit upon "go Forth and multiply" to complete the sentence "The Ace would help me ...". Some people introduced a touch of variety by tagging "by Jupiter" or "by Jove" on the end. A single dissident voice rang out from P Riley with "go Forth and mystify".

But still reeling from this torrent of identical entries we made the winner R Gibson, 39 Lisburne Lane, Offerton, Stockport, Cheshire for his straightforward "go Forth and become an Ace programmer".

Other notable entries, which also managed to break away from the standard formula, were J Gearing's "injupiterbly" and "play my other cards better — especially my graphics packs" from L Unstead-Joss. In an allusion to a claim Sinclair once made for the ZX-81, G Mason suggested that the Ace would "help me run my nuclear power station".

The Catfighter's problem was perhaps too easy. It only required a simple program to provide the solution — 2,025 Wo'ny ships and 89 lenses. A mathematical approach involved noticing that the number of ships destroyed must be a square and that there is only one square between 2,000 and 2,100.

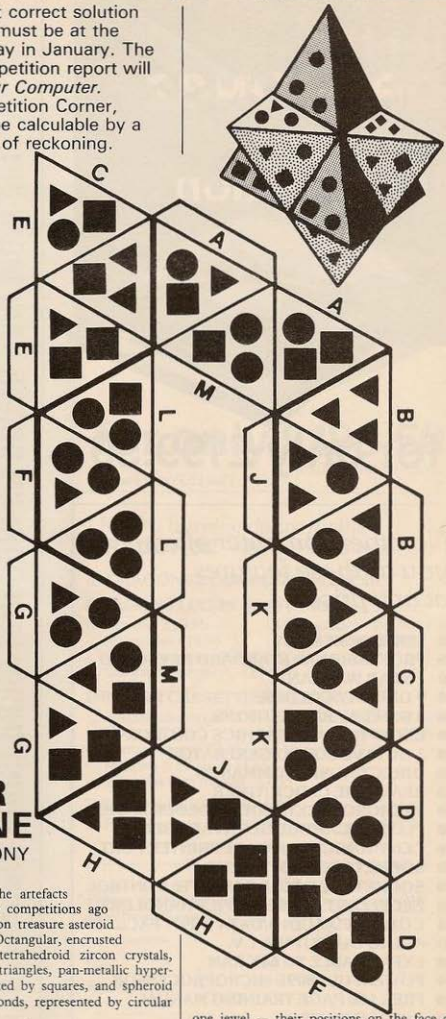
The winning solution, picked at random, was provided by P Sayer, 15 The Chase, Worlingham, Beccles, Suffolk NR34 7DW.

```
10 REM CATFIGHTER SOLUTION
15 REM BY PETE SAYER
20 C = 1999
30 C = C + 1:L = -1:W = C
40 L = L + 2:W = W - L
50 ON SGN(W) + 2 GOTO 30,60,40
60 PRINT"WONY ";C;" LENSES ";L
VARIABLES: L = LENSES
           C = INITIAL NO. OF WONY
           W = RUNNING TOTAL OF WONY
```

Solution to the November Ace crossword.

STAR STONE

BY ANTHONY ROBERTS



ANOTHER OF the artefacts you won a few competitions ago from the Klingon treasure asteroid was this Stella Octangular, encrusted with fabulous tetrahedroid zircon crystals, represented by triangles, pan-metallic hypercubes, represented by squares, and spheroid megacarat diamonds, represented by circular dots.

As with all Klingon artefacts, it's booby-trapped. Just touching any jewel on certain faces will cause the artefact to form a minute black hole, taking you with it, of course. The dangerous faces are the ones which are not on the longest closed loop of the adjacent faces. This loop is formed by moving from face to face, never repeating any face. Each consecutive face differs from the last by just one jewel — their positions on the face are immaterial.

Here's a net of the Stella Octangular. If you cut it out, fold the darker lines upwards, the others downwards, and stick the marked taps under the correspondingly-marked edges, you'll have a model of the artefact. You do not need to make the model to solve the problem. The question is: how many of each type of jewel are booby-trapped? ■

let the DRAGON 32 fire your imagination . . .

for only £199.50

Plus £5 Post & Packing

No other computer offers you all these features at <u>any</u> price . . .

- **32K RAM MEMORY**
- **PROFESSIONAL STANDARD KEYBOARD**
- **1 YEAR WARRANTY**
- **9 DISPLAY COLOURS**
- **5 DISPLAY RESOLUTIONS**
- **EXCEPTIONAL GRAPHICS CONTROL**
- **5 OCTAVE SOUND GENERATOR**
- **DIRECT MUSIC COMMANDS**
- **REAL-TIME CLOCK/TIMER**
- **MICROSOFT EXTENDED COLOUR BASIC**
- **PLUG-IN CARTRIDGES AVAILABLE**
- **CENTRONICS PARALLEL PRINTER PORT**
- **SOCKETS FOR JOYSTICKS**
- **SOCKETS FOR FULL CASSETTE CONTROL**
- **EXCELLENT CASSETTE FILE HANDLING**
- **COMBINED AUDIO/DATA INPUT FACILITY**
- **AUDIO OUTPUT VIA T.V.**
- **EXPANDABLE TO 64K RAM**
- **POWERFUL 6809E MICROPROCESSOR**
- **FREE 160 PAGE TRAINING MANUAL**
- **BRITISH MADE**

Available <u>now</u> from:

ComServe

98 TAVISTOCK STREET, BEDFORD MK40 2RX.
TELEPHONE: BEDFORD (0234) 216749

NEW SPECTRUM AND ZX81 SOFTWARE

"WINGED AVENGER"
Fast and furious. SPECTRUM version has SOUND and USER GRAPHICS. 7 LEVELS, 3 WAVES, MOTHER SHIP, HIGH SCORE, RE-FUELING, RAPID FIRE, SMART BOMBS and LASER SHIELD. PCW "ONE OF THE BEST SINCLAIR GAMES YET". Only £4.50. all SPECTURM + 16K ZX81.

"SPECTRUM SCRAMBLE"
(CONDITION RED), MORE M/CODE ARCADE ACTION NO LESS than 8 DIRECTIONAL KEYS for a SMOOTH MOVE. Full ARCADE features including, LASERS, BOMBS, INSTANT RESPONSE, CONTINUOUS SCORING ROCKETS, SOUND, FUEL DUMPS, RED METEORS, DEFENDER CRAFT and HIGH SCORE. Beware CONDITION RED. With this one you MOVE, FIRE and BOMB AT THE SAME TIME. Don't waste time waiting for explosions play THE FAST ONE. NEW RELEASE PRICE of £4.95. 16K or 48K SPECTRUM.

"CONDITION RED" ZX81
For ZX81 owners we have released a SCRAMBLE based M/CODE program written by TWO ARCADE GAMERS for home based excitment. SPEED and a very professional presentation. HIGH SCORE TABLE, SHIPS LEFT, FUEL DUMPS, AIRBORNE MISSILES and a very fancy SCROLL. Overcomes many of the ZX81's limitations and produces a good game with RAPID MOVEMENT and FIRE. See for yourself what these two young men have written. JUST £3.95. 16K ZX81.

"AUDIO SONICS"
WINNER of WIZZ KID 82. For the SPECTRUM, A.S. writes sound effects for your own programs. 26 PRESELECTED SOUND EFFECTS include TELEPHONE, POLICE SIREN, FROG, SPACE EFFECTS and OUTBOARD MOTOR. GO into MODIFY and you are presented with a display of SLIDER CONTROLS to adjust PITCH, RISE, FALL, BRISKNESS, DECEL, ACCELL, TONE, REPEAT RATE, STUTTER and DELAY. ADJUST the SLIDERS then INSTANTLY hear the SOUND CREATED. Call "THE SOUND ONE" and a program line will appear that is ready for insertion into your own programs. Hours of EXPLORATION. YOU WILL BE AMAZED what BEEP can DO. We are proud to offer this at £4.99. 16K or 48K SPECTRUM.

"SPECTRUM RENUMBER DELETE"
ALL M/CODE RENUMBERS ALL NOT PART. "YOU WON'T BUY A BETTER RENUMBER PROGRAM FOR THE SPECTRUM" JUST 600 BYTES. At £4.95. ALSO ZX81 VERSION.

"PROGRAMERS DREAM"
A SPECTRUM TOOLKIT. Position independent and just 1490 BYTES. Facilities. RENUMBER lines or blocks any increment or start. BLOCK OR LINE MOVE including a RENUMBER into place if required. BLOCK OR LINE ERASE. CHANGE SELECTED STRINGS (NAMES OR CONTENTS). DUMP variable names and values (usable in a loop). DISPLAY PROGRAM or PROGRAM plus VARIABLE SIZE. INSTANT and CLEARN. JUST £6.95 with explicit instructions.

"DO NOT PASS GO"
Renamed under protest. ZX81 simulation of the BEST SELLING BOARD GAME, PARK LANE and all that. Up to SIX players. ZX81 acts as DICE THROWER, BOARD, RENT COLLECTOR, UNPIRE, BANK, RULE BOOK, ACCOUNTANT and PROPERTY RECORD. no counters, money, board or dice needed. GAME SAVE INCLUDED, with a winner so for REPORT. Complete with instruction booklet. 16K ZX81 at £6.95.

"GREATEST GAMES V1"
This tape is aimed directly at NEW OWNERES. TEN YES 10 games on one tape. Most use M/CODE all worth playing. Written by a user and well written at that. PAC MAZE where living is winning, GOBLER eat the cells dodge the genes, STAR DEFENDER hold on till help arrives, VAMPIRES enter the COUNT the maze is a death trap, SUICIDE no winners just better losers the BLOBS win again, FROGLER good fun this, SOGGY BANKS and FLOATERS, STAR TREKER this is frustration on tape, DICTATOR an old favourite push both BUTTONS and PEASANTS. Also BOMBER bomb your way to a SAFE LANDING. 90p a game makes this the BEST ZX81 value at £5.00. 16K ZX81.

"ADVENTURE IN TIME"
A most extravagant adventure using DATA TRANSFER between programs allowing a 16K ZX81 to run around 60K of adventure. Set in AUSTRALIA . . . Save Mankind . . . Only Way . . . Time Travel . . . Time Machine . . . Warp Back . . . Probe Future . . . Consult Experts . . . Word Search . . . Cave Structure . . . Decipher Symbols . . . An AMBITIOUS MARATHON needing ARITHMETICAL and DIRECTIONAL ABILITY along with REFLEX ACTION, DEDUCTION and above all patience. KEY SECTIONS produce a different game each TIME ensuring a new challenge EACH TIME. HOURS upon HOURS of MENTAL GYMNASTICS for £8.00. 16K ZX81.

"A.D.V.E.N.T."
NOW FOR SOMETHING COMPLETELY DIFFERENT. An Eight part SYSTEM to create GAMES. The SYSTEM has particular relevance to "ADVENTURES" but has capabilities beyond its original function. Develop creative skills like PROGRAM building the APPLICATION of LOGIC and GAME CREATION without concern for the technicalities of a computer language which can be learnt later. Included is a MINI ADVENTURE to increase your understanding of the system. Games can be revised after running Programs are SAVED as M/CODE DATA FILES for the MASTER PLAY FILE to operate. BASIC lines 110 and 6500 are available for the user own routines, A.D.V.E.N.T. is the IDEAS PEOPLE. LAUNCH PRICE of just £5.95. 16K ZX81.

"TRADER JACK"
An ADVENTURE TRADING game set in the POLYNESIAN islands of the SOUTH PACIFIC. With £40,000 to buy and fit your your SHIP, purchase PROVISIONS and obtain a CARGO to TRADE on the ISLANDS. The RISKS are yours to take as are the PROFITS. Are you OUTCAST or MILLIONAIRE. Still POORER means WISER and you can surely beat the SYSTEM next TIME, TRADER JACK £5.95. 16K ZX81.

"SPACE TREK"
OH NO NOT THAT AGAIN. Not not quite. Same story only LONGER and BETTER. This one is not at all forgiving.JUST ONE MISTAKE and you are NO MORE. COPY short and long range RADAR MAPS to PRINTER, Game length is related to your RANK and the higher levels require many HOURS play. A SECOND GENERATION TREK at £5.00. 16K ZX81.

WORK FORCE (WORKS HARDER)
140, WILSDEN AVE. LUTON. BED. ENGLAND.
U.S.A. USERS WRITE TO
P.O. BOX 441 TITUSVILLE, FLORIDA 32780. U.S.A.
ALSO AVAILABLE AT BUFFER AND MICROWARE.

ZX81 GAMES

from

J.K. GREYE SOFTWARE LTD

THE NEW GENERATION SOFTWARE HOUSE

"Without question the finest machine code games available today!".....J.N. ROWLAND Product Manager for W.H. SMITH.

GAMESTAPE 1 for 1K ..... **only £3.95**
10 Games incl. ASTEROIDS, UFO, CODE, BOMBER, GUILLOTINE, KALEIDESCOPE, etc.
PROBABLY THE BEST VALUE 1k TAPE AVAILABLE.

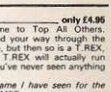
We've done in 1k, games which some of our competitors require 16k to do!

GAMESTAPE 2 for 16K ..... **only £3.95**
***STARFIGHTER** Superb machine code Space Battle. Set against a background of twinkling stars, with stunning explosions — if you can hit the enemy!
PYRAMID Can you move the Pyramid? Make a mistake and it will collapse! A Thinkers game.
ARTIST The ultimate Graphic Designers aid. 8 Directions, 10 Memories, SAVE, COPY, RUBOUT, CLS, etc.

GAMESTAPE 3 for 16K ..... **only £4.95**
***CATACOMBS** A Multi-Level Graphics Adventure. Each level can contain up to 9 Rooms, 8 Passages, 7 Monsters, Food, Gold, Traps, Phantoms, an Exit (to the next level), and there's an infinite number of levels.
NOTE. . . . . This is NOT one of the necessarily limited text Adventures as sold elsewhere.
"An excellent addictive game which will keep you amused for hours.". . . . . *COMPUTER & VIDEO GAMES.*

GAMESTAPE 4 for 16K ..... **only £4.95**
***3D MONSTER MAZE** The Game to Top All Others. Unbelievable Graphics! Can you find your way through the Maze? The EXIT is there somewhere, but then so is a T.REX, and its after YOU! All in 3D (the T.REX will actually run towards you in full perspective!), you've never seen anything like this before!
"3D MONSTER MAZE is the best game I have seen for the ZX81". . . COMPUTER & VIDEO GAMES
"If I had to choose just one programme to impress an audience with the capabilities of the ZX81, then J.K. Greye's 3D MONSTER MAZE would be the one without doubt" . . . . ZX COMPUTING. *"Brilliant, brilliant, brilliant!"*....*POPULAR COMPUTING WEEKLY*

GAMESTAPE 5 for 16K ..... **only £4.95**
***3D DEFENDER** The Ultimate Space Game. Super fast Machine Code 3D version of the Arcade favourite. You have to save your home planet from the marauding Alien Spacecraft. This is all in 3D, your viewscreen shows you the view out of your fighters cockpit window. The backdrop moves when you turn, or fly up or down (8 flight directions), just as if you were really flying it! But then YOU ARE! The Enemy Saucers will actually zoom towards you in 3D, and shoot you if you let them! Your display includes Score, Shield Strength, Altitude, Proximity, Forward Radar and your viewscreen, which shows your rotating home planet, backdrop of Stars, Meteors, Explosions, Plasma Blasts, your Photon Beams, up to 4 Enemy Saucers and of course its all in full 3D!
"Another 3D winner".....*SINCLAIR USER*



GAMESTAPE 6 for 1K ..... **only £1.95**
***BREAKOUT** Super Fast Full Screen Display Game. Your all time favourite with an added twist. See how much Money you can win and watch the pounds convert to Dollars. All in Machine Code for Fast Action with 3 Speeds, 2 Bat Sizes and three angles of rebound! The best BREAKOUT around and at this price you can't go wrong!
"The best of its kind" ..... *WHICH MICRO & SOFTWARE REVIEW*

GAMES MARKED * INCL. MACHINE CODE.
Prices include VAT and U.K. P. & P.
(Add appropriate Postage on Foreign Orders). Cheques/P.O.s to

J.K. GREYE SOFTWARE LTD

Dept YC 16, Brendan Close, Oldland Common, Bristol BS15 6QE
CREDIT CARD SALES: FOR INSTANT DESPATCH, **BY PHONE ONLY**
TEL: 01-930-9232 (9 am - 7 pm)

If you prefer to see before buying, our range of **GAMESTAPES** are stocked by the following stores.

BUFFER MICROSHOP	374A Streatham High Rd., London SW16;
GAMER	24 Gloucester Rd., Brighton;
GEORGES	89 Park St., Bristol, Avon;
MICROSTYLE	29 Belvedere, Lansdown Rd., Bath, Avon;
MICROWARE	131 Melton Rd., Leicester;
SCREEN SCENE	144 St. Georges Rd., Cheltenham, Glos;
W.H. SMITH	Over 200 Computer Branches;
ZEDXTRA	5 School Lane, Kinson, Bournemouth, Dorset:

TRADE & EXPORT ENQUIRIES WELCOME

hot stuff! DRAGON 32

for only £199.50

Plus £5 Post & Packing

I have a burning desire for the **DRAGON 32** *— Please send me:*

☐ **DRAGON 32 COMPUTER - £199.50**

DRAGON PLUG-IN SOFTWARE

☐ Berserk - £19.95 ☐ Ghost Attack - £24.95
☐ Meteroids - £19.95 ☐ Cave Hunter - £19.95
☐ Cosmic Invaders - £19.95 ☐ Tube Frenzy - £19.95
☐ Starship Chameleon - £19.95

DRAGON CASSETTE SOFTWARE

☐ Special selection 1 - £7.95 ☐ Special Selection 2 - £7.95
☐ Quest - £7.95 ☐ Graphic Animator - £7.95
☐ Computavoice - £7.95 ☐ Mazerace - £7.95
☐ Madness & Minataur - £7.95
☐ Examples from manual - £7.95

DRAGON PERIPHERALS

☐ Pair of Joysticks - £19.99 ☐ Cassette Cable - £7.95

(Add £5 Post & Packing for DRAGON 32 – £1 for accessories)

***Please debit my Barclaycard/Access account with**
I enclose Cheque/P.O. for £

*Delete as applicable

Name: .....

Address: .....

.....

..... YC

ComServe

98 TAVISTOCK STREET, BEDFORD MK40 2RX.
TELEPHONE: BEDFORD (0234) 216749

CAMBRIDGE LEARNING

SELF-INSTRUCTION COURSES

GSC SUPERKIT £19.90

Learn the wonders of digital electronics!

This practical kit for beginners comes complete with an instruction manual, components, and EXP300 breadboard to teach you all the basics of digital electronics. The course needs no soldering iron; the only extra you need to buy is a $4\frac{1}{2}$V battery.

Using the same board you can construct literally millions of different circuits.

The course teaches boolean logic, gating, R-S and J-K flipflops, shift registers, ripple counters, and half-adders.

It is supported by our theory courses

DIGITAL COMPUTER LOGIC & ELECTRONICS £6.00

which covers: basic computer logic; logical circuit elements; the design of circuits to carry out logical functions; flipflops and registers; and

DIGITAL COMPUTER DESIGN £8.50

Our latest, most up-to-date course on the design of digital computers, both from their individual logic elements and from integrated circuits. You are first shown the way in which simple logic circuits operate and then, through a series of exercises, arrive at a design for a working machine.

SPECIAL OFFER! All orders received before 25th December will be sent by 1st Class post at no extra charge.

GUARANTEE No risk to you. If you are not completely satisfied, your money will be refunded upon return of the item in good condition within 28 days of receipt.

CAMBRIDGE LEARNING LIMITED, UNIT 82 RIVERMILL SITE, FREEPOST, ST IVES, CAMBS, PE17 4BR, ENGLAND. TELEPHONE: ST IVES (0480) 67446. VAT No 313026022

All prices include worldwide postage (airmail is extra - please ask for prepayment invoice). Giro A/c No 2789159. Please allow 28 days for delivery in UK.

.....SUPERKIT(S) @ £19.90
.....DIGITAL COMPUTER DESIGN(S) @ £8.50
.....DIGITAL COMPUTER LOGIC AND ELECTRONICS @ £6.00

I enclose a *cheque/PO payable to Cambridge Learning Ltd for £..... (*delete where applicable)

Please charge my:

*Access / American Express / Barclaycard / Diners Club Eurocard / Visa / Mastercharge / Trustcard

Expiry Date..... Credit Card No .....

Signature.....

Telephone orders from card holders accepted on 0480 67446

Overseas customers (including Eire) should send a bank draft in sterling drawn on a London bank, or quote credit card number.

Name.....

Address.....

.....

..... GSCUnit81

Cambridge Learning Limited, UNIT 82 Rivermill Site, FREEPOST, St Ives, Huntingdon, Cambs, PE17 4BR, England. (Registered in England No 1328762).

THE SPECTRUM 'ADD-ON'

KRAK! BLADAMM!!

ONLY £19.50 + VAT

COMPLETE your SPECTRUM with our Multi-purpose Sound Generator and Joystick-port Board!! With one low-cost purchase you can obtain the following outstanding improvements to your ZX SPECTRUM:

- THREE CHANNEL sound effects. PROGRAM three independent sounds with music, gun shots, explosions etc.
- AMPLIFICATION of the standard sound output.
- PROVISION of JOYSTICK PORTS to allow simple connection of one or two suitable joysticks (see below).

The 'ADD-ON' uses the amazing AY-3-8910 SOUND Chip, which gives you an enormous range of sound effects. The output and volume of each channel can be separately controlled, with gun shots, explosions, drums etc., produced under the 'sound envelope'. MOST IMPORTANT TO NOTE—the CHIP is 'processor independent.' This means that sounds can continue to be produced without any noticeable effect on the speed of your program!!

The 'ADD-ON' contains its own speaker and amplifier chip and is supplied with a cassette containing sound demonstration routines and some sample sounds.

The 'ADD-ON' simply plugs straight onto the back of your SPECTRUM. No soldering is required.

The 'ADD-ON' is offered at the incredibly low price of £19.50 + VAT.

COMPLETE YOUR SPECTRUM NOW!!

JOYSTICK KITS £3.95 + VAT
To complement our exciting new 'ADD-ON' for the SPECTRUM we are offering low-cost Joystick Kits. Each one contains a potentiometer-joystick, a fire-button and a suitable connector.

NEW ORIGINAL SPECTRUM SOFTWARE
—from PROGRAM POWER—using the 'ADD-ON' to great effect!!

CABMAN (Machine Code) £3.95 + VAT
You are the owner of a fleet of yellow taxis. A rival firm competes with you, trying to steal your fares and run you off the road, if they can. Ten skill levels determine the number of opposing taxis, the speed at which they drive and the amount you earn per completed journey. MAXIMISE your earnings before you lose your entire fleet. This program is FIRST CLASS.

ATTENTION MACHINE CODE PROGRAMMERS!
We can now offer SPECTRUM versions of the ASSEMBLER and DISASSEMBLER programs from ACS Software. The ZX81 versions have proved extremely popular.

ULTRAVIOLET (Assembler) ..... £6.95 + VAT
INFRARED (Disassembler) ..... £5.95 + VAT

BOOKS

SPECTRUM
Over the Spectrum £6.95
Cambridge Colour Collection £6.95

ZX81
Mastering Machine Code on your ZX81 ..... £7.50
NOT ONLY 30 Programs £6.95
Getting Acquainted with your ZX81 ..... £5.95
49 Explosive Games for the ZX81 ..... £5.95
Making the most of your ZX81 ..... £5.95
Byteing Deeper into your ZX81 ..... £4.95
The Explorer's Guide to the ZX81 ..... £4.95

BBC, DRAGON & ACORN DEALERS

MICRO POWER

NOTE: We stock (and market) PROGRAM POWER SOFTWARE for the BBC, ACORN, SPECTRUM and DRAGON 32. Send S.A.E. for appropriate catalogue.

8/8a REGENT STREET, CHAPEL ALLERTON, LEEDS LS7 4PE. Tel: (0532) 683186

All programs are now available at all good dealers or direct from MICRO POWER LTD.

Please add 55p order P.&P. + VAT at 15%

WRITTEN ANY PROGRAMS! WE PAY 20% ROYALTIES FOR DRAGON, SPECTRUM BBC, ATOM PROGRAMS

POWER MICRO PROGRAM POWER MICRO PROGRAM POWER MICRO PROGRAM POWER MICRO PROGRAM

THE ADVENTURE GAME THAT'S FOR REAL !!!!

£6,000 PRIZE! FREE HIT SINGLE! 48K ZX SPECTRUM

(16K ZX81 VERSION NOW AVAILABLE)

Will you be the first to locate the Golden Sundial of Pi in time and space, and be rewarded with the original? Exquisitely crafted by the winner of the De Beers Diamond International Award, from gold, diamond and the most precious of the earth's riches.

PIMANIA - where saxophones turn into hangliders, where music meets madness and where the Pi Man rules supreme! He'll talk with you, he'll befriend you, he'll betray you, he'll even do the Hokey-Kokey! Animated cartoon graphics! Full musical score! Spectacular colour and sound effects! Includes free hit single "Pimania", with vocals by Clair Sinclive and the Pi Men!

It could take you a week to play, it could take you a lifetime! PIMANIA, " the best evidence that computer gaming has come of age . . . an adventure enthusiast's dream!" (Computer & Video Games)

An investment at £10 (48K Spectrum) £8 (16K ZX81)

Automata Ltd. (YC)
65a Osborne Road
Portsmouth PO5 3LR
England

BBC nascom SPECTRUM

adventure

Colossal Adventure: The classic mainframe game "Adventure" with all of the original treasures and creatures plus 70 extra rooms!

Adventure Quest: From the Great Forest; up Orc Mountain; through caves, desert, swamp, fire, lake and bleak moorland on an epic quest to defeat Tyranny.

Dungeon Adventure: NEW! The dungeons of the Demon Lord have survived His fall. Can you acquire their treasures first?

Each Level 9 adventure is packed with puzzles and has over 200 individually described locations – a game could take weeks to complete! Only data and code compaction allow us to provide so much.

Each adventure requires 32K of memory & costs £9.90 (including VAT and P&P).

Send order, describing your computer, or a SAE for full details to:

LEVEL 9 COMPUTING
229 Hughenden Road, High Wycombe, Bucks

BRITAIN'S LARGEST SINGLE MICRO USER GROUP

BEEBUG FOR THE BBC MICRO

INDEPENDENT NATIONAL USER GROUP FOR THE BBC MICRO

MEMBERSHIP NOW EXCEEDS 10,000

BEEBUG runs a regular magazine devoted exclusively to the BBC Micro (10 issues per year). Now 36 pages.
First issue April 1982. Reprints of all issues available to members.
Programs – Hints and Tips – Major articles – News – Reviews – Commentary.
PLUS members' discount scheme PLUS members' software library.

April Issue: 3D Noughts and Crosses, Moon Lander, Ellipse and 3D Surface. Plus articles on Upgrading to Model B, Making Sounds, and Operating System Calls.
May Issue: Careers, Bomber, Chords, Spiral and more.
Plus articles on Graphics, Writing Games Programs, and Using the Assembler.
June Issue: Mazetrap, Mini Word Processor, Polygon; plus articles on Upgrading, The User Port, TV set and Monitor Review, Graphics Part II, More Assembler Hints, Structuring in BBC Basic, plus BBC Bugs.
July Issue (36 pages) Invaders and patchwork programs. Fix for BBC cassette Bugs, Mode 7 explored, User define Keys, Software reviews, High res graphics printout, RS423 receive fix.
September Issue: Games programs! Higher/Lower, Hangman, plus string search program. Articles on debugging programs, a Safe Verifier, new User guide, errata, creating and moving multicolour characters, logic and the Beeb, ideas on colouring and shading, Acorn's ROM replacement charge plus much more.
October Issue. Program features: alien attack, calendar generator, Union Jack, memory display utility. Articles on debugging, improving key detection, Acorn press release on O.S.1.2. issue II Basic, the tube and second processor options, a new series for less - experienced users, software reviews.

Membership
6 months £4.90, 1 year £8.90
Send £1.00 and A4 SAE for sample
Overseas 1 year only:
Europe £15.00, Middle East £18.00
Americas & Africa £20.00,
Other countries £22.00.

Make cheques to BEEBUG and send to BEEBUG, Dept 4, 374 Wandsworth Rd., London, SW8 4TE.

SF GOBBLERS

PUCKMAN FOR 16K ZX81

BEAT THAT HIGH SCORE! GOBBLE THOSE DOTS BEFORE THOSE MEANIES GOBBLE YOU! YOUR ONLY AIDES ARE FOUR "POWER PILLS" WHICH MAKE THE MEANIES EDIBLE. BUT NOT FOR LONG!

- MACHINE CODED FOR FAST ACTION
- EXTRA "GOBBLER" FOR 10,000 POINTS
- ON SCREEN SCORING
- HIGH SCORE WITH "ENTER NAME" FACILITY
- UP TO 4 PLAYERS

AN ANNOYINGLY FRUSTRATING GAME! FOR ONLY £5.95

SF ASTEROIDS FOR 16K ZX81

STAY ALIVE AS LONG AS POSSIBLE IN OPEN SPACE FILLED WITH FLYING ROCKS. SCORE BY SHOOTING THEM – WHICH ALSO CAUSES THEM TO BREAK INTO LOTS OF LITTLE BITS AND MAKES LIFE EVEN WORSE!

- MACHINE CODED FOR FAST ACTION
- ON SCREEN SCORING
- HIGH SCORE WITH 'ENTER NAME' FACILITY
- UP TO 4 PLAYERS
- EXTRA SHIP FOR 1,000 PTS (NOT AS EASY AS IT SOUNDS!)
- SHIP MOVES JUST LIKE ARCADE VERSION
- ROTATE LEFT/ROTATE RIGHT/THRUST
- FIRES IN ALL 8 DIRECTIONS
- INCREASING NUMBER OF ASTEROIDS
- THREE ASTEROID SIZES
- 'NASTY' ALIEN SPACE SHIP (FIRES BACK!)

THIS GAME IS JUST AS BAD! – AND ONLY £5.95
AN OFFER FOR REAL MASOCHISTS – BOTH TAPES FOR £9.95

MAIL ORDER ONLY-PLEASE MAKE CHEQUE/PO PAYABLE TO

SF THE SOFTWARE FARM DEPT B SF
CRAIGO FARM, BOTANY BAY, TINTERN, GWENT

MEMOTECH

MEMOPAK 16K For those just setting out on the road to real computing, this pack transforms the ZX81 from a toy to a powerful computer. Data storage, extended programming and complex displays become feasible.
For even greater capacity, memory packs can be added together (16 + 16 + 16K or 16 + 32K). The MEMOPAK 32K and the MEMOPAK 64K offer large memories at economical prices.

MEMOPAK HRG This pack breaks down the constraints imposed by operating at the ZX81 character level and allows high definition displays to be generated. All 248 × 192 individual pixels can be controlled using simple commands, and the built in software enables the user to work interactively at the dot, line, character, block and page levels. Scrolling, flashing and animation are all here.

MEMOPAK Centronics I/F The BASIC commands LPRINT, LLIST and COPY are used to print on any CENTRONICS type printer. All ASCII characters are generated and translation takes place automatically within the pack. Reverse capitals give lower case. Additional facilities allow high resolution printing. The full capabilities of your printer are now under the control of the ZX81.

MEMOCALC The screen display behaves as a 'window' on a large sheet of paper on which a table of numbers is laid out. The maximum size of the table is determined by the memory capacity, and with a MEMOPAK 64K a table of up to 7000 numbers with up to 250 rows or 99 columns can be specified. Each location in the table can be either a number which is keyed in or a formula which generates a number. Every time the command to 'calculate' is given, all the formulae in the table are re-evaluated. Spreadsheet analysis started as an aid to cash-flow analysis, but this powerful tool has now been generalised and MEMOCALC with its special ability to perform iterative calculations is invaluable in the performance of numerical tasks.

16K £26.00 + £3.90 VAT £29.90
32K £43.43 + £6.52 VAT £49.95
64K £68.70 + £10.30 VAT £79.00
HRG £34.70 + £5.20 VAT £39.90
CI/F £34.70 + £5.20 VAT £39.90
MEMOCALC £26.00 + £3.90 VAT £29.90
KEYBOARD WITH INTERFACE
£43.43 + £6.52 VAT £49.95

Memotech products are available at larger branches of **WHSMITH**

realises the ZX81 potential

The Memotech approach to microcomputing is to take the well-proven and popular ZX81 as the heart of a modular system. This small computer houses the powerful Z80A processing unit and acts as the central processor module through which the MEMOPAKS operate.

Memotech has a reputation for professional quality, producing units which are designed to fit perfectly, to look well-balanced, and to work efficiently and reliably.

The modular approach gives ZX81 owners the freedom to design the system they really need. Furthermore, the intercompatibility of the modules ensures that later additions will click straight in, to give you a system that grows with your ambitions and abilities.

To ensure that your expectations are realised, care is taken at every stage to design features into the system to anticipate your frustrations and to forestall them. For example:

A) Memories are cumulative e.g. 16K and 32K can be added to the MEMOPAK 16K or even to the Sinclair 16K RAM pack.

B) The HRG firmware allows commonly used constructions (such as scrolling, shading and labelling graphs), which might otherwise be beyond the user's programming capabilities, to be evoked by a few simple commands.

C) The Centronics I/F converts ZX81 character codes into ASCII and extends the print line to the width of the printer, still using the LLIST, LPRINT and COPY commands.

As one example, a system with 16K of memory and MEMOCALC is all that is required to perform sophisticated numerical calculations giving the same results as a computer at 10 times the price. The problem may be as complicated as a cash flow or production schedule, or as simple as household accounts or pocket money budgeting. If the bank manager wants to see the cash flow, then a single print instruction to the Centronics I/F will give a printout which is more than acceptable to any bank.

The example system which is shown below, on the other hand, would satisfy the needs of someone who wanted to enter data via a light-touch keyboard, construct and label graphs, and then copy the screen to an 80-column printer. Only 16K of memory is used here but with additional memory, more than one video page can be stored. Up to 7 successive pages can be displayed cyclicly to give animated displays.

Looking forward, Memotech will continue to back the ZX81 through 1983 with fast storage devices, pressure sensitive electronic drawing boards and more software packs including a wordprocessor, an RS232 interface and a Z80 assembler.

MEMOPAKS may be ordered by post (cheque, Access/Barclaycard quoting number) or by telephone. Please make cheques payable to Memotech Ltd. and please include £2.00 per unit for packaging and postage inland (overseas £3.00).

We want to be sure you are satisfied with your Memopak – so we offer a 14-day money back guarantee on all our products.

MEMOTECH LIMITED
3 COLLINS STREET
OXFORD OX4 1XL ENGLAND

TEL. 0865 722102
TELEX 837220 ORCHID G

Data Draw

WHY NOT KICK OFF WITH DATA DRAW CASSETTE

The pools forecasting program using team form to give best selections.
A statistical comparison process evolved from a research program using 5 years of fixtures and results will give you a unique chance of scoring.
This program was proven on calculator featured on T.V. and in press.

IF YOU PLAY TO WIN send now, only **£7.50** inc. p.p. to

Compselect:
277B Gloucester Road
Cheltenham
Gloucester
GL51 7AA

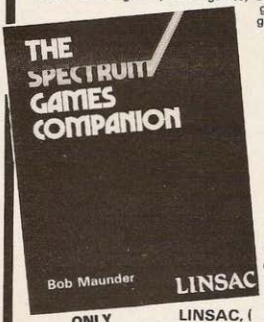
£7.50

Linsac's ZX Companion series has received excellent press reviews:

"Far and away the best" — *Your Computer*

Thoughtfully written, detailed and illustrated with meaningful programs ... outstandingly useful" — *EZUG*

'The Spectrum Games Companion' is the latest addition to the series and is aimed at the games player and programmer alike. Twenty-one games designed specifically for the ZX Spectrum are included, with clear instructions on entry and play. Each program is explained fully with complete details on how it is designed and written. Introductory chapters show how to set up and use the Spectrum and how to create your own games. Later sections cover number games, word games, board games, simulation games, dice games, card games and grid games. If you want to enjoy your ZX Spectrum and learn its secrets at the same time then this is the book for you!



Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

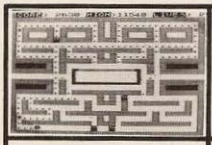
The Spectrum Games Companion is available from good book shops, or send £5.95 to:

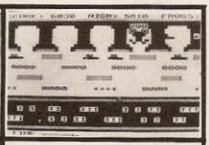
ONLY £5.95

LINSAC, ( ) 68 Barker Road, Middlesbrough, Cleveland TS5 5ES

Postage is free within the U.K. — add £1 for Europe or £2.50 outside Europe.

ISBN 0 907211 02 X





ZUCKMAN
ZX81 (16K)
- *ALL MACHINE CODE (10K)
- *FOUR INDEPENDENT GHOSTS
- *HIGH-SCORE 'HALL OF FAME'
- *AUTHENTIC ARCADE ACTION
- *TITLE/DISPLAY MODE

ONLY £5.95 INC. P&P

FROGGER
ZX81 (16K)
- *MOVING CARS, LOGS, TURTLES
- *ALLIGATORS, DIVING TURTLES
- *FOUR 'SCREENS' OF ACTION
- *ALL ARCADE FEATURES
- *ENTIRELY MACHINE CODE

ONLY £5.95 INC. P&P

NEW ☆ **DRAGON 32 SOFTWARE** ☆ NEW

MISSILE COMMAND ..... **ONLY £5.95**
FULL HIGH-RESOLUTION COLOUR GRAPHICS + SOUND

GRAPHICS DEMONSTRATOR ..... **ONLY £5.95**
LEARN THE SECRETS OF HI-RES GRAPHICS PROGRAMMING

DJL SOFTWARE
DEPT YC, 9 TWEED CLOSE, SWINDON, WILTS SN2 3PU

TRADE ENQUIRIES WELCOME

AMBA SOFTWARE

FAST ACTION GAMES FOR THE SPECTRUM AND ZX81 ALL IN MACHINE CODE

SUB TRACK (SPECTRUM) Use your wits to destroy the enemy submarines with depthcharges, but watch out for their mines and their secret weapon. Your ship could be blown out of the water. 24 game variations.

TREASURE HUNT (SPECTRUM) Explore one of the 29 mazes in search of treasure and grab as much as you can. This game can be played with or without moving obstacles; with one player, two players in opposition, or two players in partnership; and with part or all of the maze invisible. There are 144 variations of this fascinating game and even the game selector is fun to use.

HUNT (16K ZX81) A ZX81 version of Treasure Hunt with 48 variations.

X-MEN (16K ZX81) The only Puckman type game with all of these features: true gobbling action, bonuses, arcade type maze, 3 lives, graphic display of lives left, 4 monsters, a den, booster buns, high score, continuous on-screen scoring.

SNACKMAN (SPECTRUM) All the features of X-MEN plus 16 mazes, 10 speeds, and of course, high resolution colour graphics and great sound effects.

UFO (16K ZX81) A fast moving space game, not recommended unless your reations are lightning fast.

TRAP (16K ZX81) You control a growing wall and try to surround your opponent (computer or human) before he surrounds you. 12 variations.

£4.95 PER GAME ON CASSETTE

Available from:-
BUFFER MICRO, LONDON
PHILLIP COPLEY, OSSETT
GAMER, BRIGHTON
GEORGES, BRISTOL
MICROWARE, LEICESTER
SCREENSCENE, CHELTENHAM

By Mail Order
Cheque/P.O. To:
AMBA SOFTWARE
FREEPOST
(no stamp required)
CAMBRIDGE
CB3 7BR

LET ACORNSOFT OPEN THE DOORS TO YOUR IMAGINATION

BBC Microcomputer or Acorn Atom

Acornsoft is the software division of Acorn Computers, designers and manufacturers, of the BBC Micro and Atom. We know better than anyone the capability of the machines, we know how to get the very best from the hardware. And we have produced a range of exciting games, exacting business and useful household software.

The Biggest Range Available

Acornsoft software ranges from authentic arcade games like Snapper to Algebraic Manipulation to Desk Diary to other languages like FORTH and LISP. Striking colour, amazing sound effects and powerful graphics are all used to the full. And it does not stop there. There is a complete range of manuals, accessories and plug-in ROMs.

Free Brochures

Just clip the coupon or write to us and we will rush our catalogue absolutely free. Can't wait for the post ring 01-930 1614 now! Don't delay – do it today. Let Acornsoft help you get the best from our machine and open the doors to your imagination.

Acornsoft and Atom are registered trade marks of Acorn Computers Ltd.

ACORNSOFT
4A Market Hill,
CAMBRIDGE CB2 3NJ.

Please rush me my free literature from Acornsoft.

☐ Atom ☐ BBC Please tick

Name

Address

Postcode

ADVENTURE

BBC *Micro 32K*

Xanadu Adventure

You've never played an Adventure like this before! You can play it as a normal one-player Adventure or you play it with someone else. With two players you take it in turns to explore. Each player buys his provisions and weapons, and then you can explore, making (and breaking) an alliance as you wish. As allies, you explore together and your combined strength helps you in fights with monsters. If you're not allies, you can fight one another and steal each other's treasures and artifacts.

Explore the caves and castle of Xanadu: over 100 locations, lots of treasures and monsters, in different places each time you play. High speed save and restore. Written in assembler, with highly compressed data for a really big and difficult Adventure.

£7.75 1200 baud cassette. 300 baud available on request.

Acorn Atom 12K

Atom Adventure

A traditional Adventure in caves and a castle. A best-seller from Hopesoft for 15 months. Now only £5.75.

Pirate Island

Can you get your treasure back to your ship? Beware of the crocodile and the natives! Don't dig for treasure till you've read the map!
"An excellent piece of software":
Computer & Video Games. £6.75

HOPESOFT

Hope Cottage, Winterbourne, Newbury, Berks RG16 8BB

STAR SOCCER

AN EXCITING NEW GAME FOR THE ZX81 (16K)

- ALL THE ACTION OF REAL FOOTBALL PASS – SHOOT – DRIBBLE – TACKLE CORNERS – FREE KICKS – THROW-INS
- YOU PLAN THE MOVES – SEE THE PLAY IN HIGH SPEED GRAPHICS
- MATCHES BETWEEN 12 TOP CLUB SIDES AND 12 *STAR* WORLD CUP SQUADS
- MORE THAN AN ARCADE GAME MORE THAN A SIMULATION

'A truly original and absorbing game'

ONLY £5.95

Please make cheques and postal orders payable to:

Watson Software Services Ltd.

1, Ivy Cottages, Long Road West, Dedham, Essex CO7 6EL

Allow 14 days for delivery

SOFTWARE HOUSES, WHOLESALERS, DEALERS

YES. WE MANUFACTURE CASSETTES

DUPLICATING – Need 50 – 50,000 Program Copies within 10 days?

Short-run in-cassette copying, high-speed volume duplicating, with on-cassette body printing, labelling, over-wrapping, blister-carding etc. And YES – we verify our work – methodically.

BLANKS – Need any length blank cassette for copying or re-sale?

We manufacture tapes in bulk, with or without boxes, as well as our own fully-packaged standard length products.

We use high quality batch certified HM-1260 tape, for error-free copies.

Please ring or write to Nigel Boyle today for full details – all enquiries and material treated in the strictest confidence.

Phone
01 223 5955

Write to
BIBI Magnetics yc
Freepost
London SW11 2BR

BiBi Magnetics Limited,
101/105 Plough Road, London, SW11 2BJ

A TOTALLY NEW AND ORIGINAL GAME FROM SOFTWARE FARM FOR 16K ZX81

NEW!

the Super Scramble

YOUR MISSION

To penetrate the Witches Defences, Enter her Cavern and Destroy her wicked Heart

THE WITCHES DEFENCES

STALAGMITES AND STALACTITES which grow across your path. Blast a way through with your Lazer Cannon (but beware – a surprise is in store fore you!).
VOLCANOES to get past alive – if you can! – an ever increasing amount of white-hot Larva to avoid the closer you get to the witches cavern.
VAMPIRE BATS that cling to your ship, making your controls sluggish and finally (if you are not careful) dragging you down to your destruction.
CAVE-INS should you hit the side of the cave with your Lazer Cannon or Bomb, part of the roof will cave-in on you – the greater the landslides to avoid each time!.
THE NEARER you get to the Witches Cavern, the more of her Defences she will throw at you at once. Should you survive all of them (highly unlikely) then you must contend with the Witch herself! Avoid being turned to stone by her spells while attempting to destroy her wicked Heart!.

- **Written entirely in Machine Code**
- **Hall of Fame**
- **1 or 2 Players**
- **Mystery Score positions to bomb**
- **5 Skill Levels**

DESTINED TO BECOME A CLASSIC!

AND ONLY £5.95

THE SOFTWARE FARM
CRAIGO FARM, BOTANY BAY, TINTERN, GWENT

EDUCATIONAL COMPUTING on the

ZX81

Suit children ages 5–11

strongly recommended by educational authorities

No comparable collection offers so much for so little

Fifty high-quality programs to turn your ZX81 or Spectrum into a powerful educational tool.

And you don't even need to know programming. There are clear instructions and plenty of tips & advice. Designed to go beyond drill & practice the promote learning through interaction & discovery.

Almost all programs work on the **SPECTRUM**

All programs fit 1K
Creative use of graphics
Many innovative ideas
Fully documented
Includes many games

Educare's **50** 1K PROGRAMS for PRIMARY EDUCATION

Includes:–

TORTOISE
A simplified version of the famous Turtle programme

CODED MISSILE
Combines the fun of arcade games with learning

£5·95 only
paperback 110 pages plus Spectrum supplement

Graph-plotter ● Histogram ● Simon-spell ● Sketchboard ● Times-table ● Sets
Series-quiz ● XY-coordinates ● Count ● Equations ● Areas ● Guess-a-Volume
Angles ● Upstairs-Downstairs ● Music-notes ● See-saw ● Wipe-out ● Spell
Temperature ● Clock ● Money ● Snake
Mastermind ● Number-shoot ● + 26 more

EDUCARE

To: EDUCARE
139a Sloane St
London
SW1X 9AY

Please send me .....copies Educare's 50.
I enclose cheque/postal order for £ .....
Name .....
Address .....
.....

Let your child benefit early - Send now

PASCAL FOR THE ZX SPECTRUM

Hisoft are pleased to announce the availability of Hisoft Pascal 4 for the 48K ZX SPECTRUM.

No longer do you have to put up with the slow execution speed of BASIC programs; Hisoft Pascal 4 produces programs that run between 40 and 100 (yes 100!) times faster than the equivalent programs written in ZX SPECTRUM BASIC. For example, a program to sort a 100 element array of numbers into ascending order takes 60 seconds in BASIC, while HP4 produces a program which does the same thing in 0.6 seconds!

NOW you and your children can learn to program in an efficient and structured way by using Pascal, the favoured language in schools and universities.

NOW you can write games programs etc. which run as fast as you need them to without having to resort to assembler or machine code.

NOW you can use a language which requires minimal re-learning when you move from your SPECTRUM to another computer; Hisoft Pascal 4 has all the essential features of Standard Pascal as detailed in the Pascal User Manual and Report — by Kathleen Jensen and Niklaus Wirth, the man who designed Pascal.

Hisoft Pascal 4 is a professional piece of software designed by a team who have been writing Pascal compilers for many years — you will find it to be powerful, flexible and very easy to use.

To top it all, we are offering the package (which includes a 60 page manual), for a limited time, to 48K ZX SPECTRUM users at an INCREDIBLE price of:

ONLY £25 INCLUSIVE

Write for more details TODAY to:

HISOFT
60 Hallam Moor
Liden SWINDON
SN3 6LS

Tel. (0793) 26616 (Answering machine)

CRYSTAL MACHINE CODE UTILITY PACKAGES

MONITOR AND DISASSEMBLER: This powerful utility features all standard monitor functions plus many extra routines designed by programmers for programmers to make this the only monitor you'll ever need. Including one touch 'keyword' entry, block print, tabulate, copy and verify, stringfind, run with breakpoints, jump relative calculator, Hex/Decimal interconversion, assign to, display and alter CPU registers, a full editor and more! (ZX-81 LOAD and SAVE at 3 times normal speed.) Runs in 4K on the ZX-81 and ZX Spectrum (16K or 48K).

ZEUS SPECTRUM ASSEMBLER: Zeus is a high speed 2 pass assembler for the 48K machine developed from the tried and tested Nascom package. Operating on ALL of Zilog's Z80 mneumonics the assembler includes many useful facilities, notably a superb onscreen editor, auto-line numbering and full symbol table listing. Included in the package is a self contained monitor with routines enabling you to look through and modify memory.

These essential aids for the serious programmer come with their own detailed instruction manual for £8.95 each or just £14.95 the pair.

CRYSTAL GAMES PACKAGES

MERCHANT OF VENUS (ZX-81 + 16K): This absorbing graphics game combines the skill of 'Lunar Lander' as you pilot your freighter above the spaceports of Venus with the market strategy of 'Stock Market' as you wheel and deal in Cyborgs, Robodrones and much more! But beware — maintaining your ship is expensive and poor landings will cost you heavily in repairs. Start trading today for only £6.95.

1K GAMES TAPE: Simply the ultimate in 1K programs: 4 flicker-free graphics games all with onscreen plus a challenging puzzle to solve. Includes Astravoid, Bomber, Super Slalom, Invaders and Dungeon Quest. All 100% machine code for super-smooth, super-fast action! Great value at just £4.95.

Send sae. for our latest catalogue detailing these and much more ZX software
Please add £0.50 p&p and make cheques POs etc. payable to:

CRYSTAL COMPUTING
50 Charles Close, Wroxham, Norwich NR12 8TU

Dealer enquiries welcome. Good royalties paid for good software.

IF YOU WANT:

*The Latest News on the BBC Micro
*Top Quality Programs
*Useful Hints and Tips
*Honest Reviews
*Independent Opinions
*Local User Group Information
*Members Special Offers

THEN YOU NEED:

LASERBUG

The Newsletter of the Independent National BBC Microcomputer User Group.
MEMBERSHIP: £12 for 1 year (£15 overseas) or send £1 and an A4 size SAE for a sample copy.

Write to:

LASERBUG, 10 Dawley Ride, Colnbrook, Slough, Berks., SL3 0QH

Members in 14 Countries Worldwide

ATTENTION DRAGON OWNERS

S.W. Winter announce the launch of their exclusive new range of Dragon software

THE RING OF DARKNESS
The first fully hi-res graphic adventure game for the Dragon. You create your own character and set off across an enchanted land, entering towns to buy essential goods and daring the depths of vast, monster filled 3D dungeons. Time and experience will lead you to discover the secret quest, if you survive. SAVE GAME FACILITY.
£10.00

DRAGON TREK
An advanced Star Trek game in hi-res colour. Mixed text and graphics, moving klingons, 5 skill levels, onboard computer and REAL TIME INTERACTION will have you zapping klingons till stardate 2475.
£6.99

ARTISTS DESIGNER
Use the Dragon's powerful hi-res graphics in a truly artistic manner. Moving screen cursor, cassette save function and slide show.
£5.99

THE MINSTREL
A graphic music sheet and standard musical notation allow you to compose masterpieces and save them on cassette. ENTERTAINING and EDUCATIONAL.
£5.99

PEPPER'S BASIC GAMES — VOLUMES 1 & 2
A wide selection of entertaining, educating games by Sol Pepper, written in Dragon Basic so you can LIST & LEARN.
£5.99 each volume

Prices include P&P.
Make cheques/POs payable to
S.W. WINTER & CO. LTD.
101 Westminster Bridge Road,
London SE1
Telephone: 01-928 5945 or 01-633 9611
DRAGON 32's IN STOCK NOW £173.00 + VAT.

✱NEW✱

SPECTRUM ZX81
SEVERN SOFTWARE

- **GRAIL (16K & 48K SPECTRUM)**
  Exciting new graphic adventure. Where in the 1000 rooms is the Holy Grail! Gather armour and weapons to fight Dragons, Orcs, Wolves. Find Gold and Precious Stones to buy strength potions from a Trader. Stairways to all 10 levels. Where will the Warp take you to? If you lose, you can watch yourself bleed to death! Full M/C sound effects and Save Game facility £4.95 inc.
  Also ZX81 – 16K version £4.45 inc.
- **MINES OF MORIA (48K SPECTRUM)**
  A challenging adventure set in the Mines of Moria. Collect as much treasure as you can but if you can't remember your route you may never get out! Full graphic display of each location. Save Game and Reset facilities. £5.95 inc.
  Also ZX81 – 16K version £4.95 inc.
- **SNAPPER (16K – ZX81)**
  Fast M/C action. Avoid the Snappers and stay alive! Features on-screen scoring and automatic restart. £3.75 inc.
- **1K ZX81** owners-send for our list of Fast M/C Games (s.a.e. please).
- **STATISTICS (16K & 48K SPECTRUM)**
  Powerful Statistics Package. Menu-Driven. Features Means, Standard Deviations, True Linear Regression, Pearsons Coefficient of Correlation. Extensive Data Editing routines. Full Graphic display of data and regression lines. Saves named data files. Supports ZX Printer. £6.95 inc.
  Also ZX81 – 16K version £6.45 inc.
- **THE M/C MANUAL**
  Easy to use (can be used by the absolute beginner). Fully detailed guide to Z80 Op Codes and M/C Programming. Convenient A4 format. Fully documented tables of codes, displacements and number conversions. Easy to follow diagrams and routines throughout.
  designed to use not just to read. £2.95 inc.
- Send S.A.E. for full list and prices for Spectrum and ZX81 software.
- Cheques/P.Os to:

SEVERN SOFTWARE
5, SCHOOL CRESCENT, LYDNEY,
GLOS GL 15 5TA

We Guarantee to replace* **at once *any cassette sold by us that fails to load on receipt.*

Computersmith

BBC – ACORN ATOM – VIC 20

BBC SOFTWARE
GOLF(for Model B) £5.50
Full colour version with fairway, trees, green, bunker etc. Club selection and strength of shot. Stroke by stroke display.
GUZZLER (for Model B) £5.50
Arcade style game including full colour and sound effects.
COPTER FIGHT (for Model B) £5.50
Desert battlefield with convoy subjected to aerial attact.
GAMES PACK 1 (for Model A) £5.50
Three games simulating motor racing, a sea battle and motor cycling stunts (Silverstone, Midway and Stuntman)

VIC 20 SOFTWARE
MAZMEGOLD (3K or 8K expansion) £4.95
Guide your intrepid explorer through the marble halls avoiding monsters and pillars to collect the gold bags.
MUD BATH (3K or 8K expansion) £4.95
A mother's work is never done. Catch the washing as it falls from the washing line towards the muddy puddles.

ACORN ATOM SOFTWARE
GOLF (for 12K + 12K Atom) £4.95
Select your club, drive from the tee and see a map of the hold. Stroke by stroke display. 9 hole course, score card and comparison with par. Built in problems of slicing, bunker shots etc.
DETECTIVE (for 12K + 12K Atom) £4.95
Search the old manor house for clues to the murder. Plan of the rooms and red herrings galore. Record your information on the sheets provided and find the killer. A classic whodunnit.
GUZZLER (for 12K + 12K Atom) £4.95
Version of the classic arcade game. Full sound and graphics effects.

NOTE: All prices are fully inclusive (postage, packing etc.) Send a cheque or postal order (no cash) with your order to:
(Remember to include your NAME & ADDRESS)

COMPUTERSMITH
40 Greenfields Avenue, Bromborough,
Wirral, Merseyside, L62 6DD.

Professionally Written and Produced Software for the Home Computer
From M. E. Evans the author of the highly acclaimed **3D MONSTER MAZE** and **3D DEFENDER** for the ZX81 comes **TWO GAMES FOR THE SPECTRUM**

Available mid-Jan.

3D TUNNEL
(16K & 48K versions on one tape)
What lies down in the depths of the TUNNEL? Flying bats, leaping toads, spiders*, and rats* maybe. Perhaps more! You will have to avoid the walls of the TUNNEL as it weaves up & down and side to side to find out. All in 3D of course (* not in 16K version).

ESCAPE (runs in 16K)
Can you ESCAPE from the maze inhabited by 5 hunting Dinosaurs, including a Pteranodon that soars over the maze to swoop down on you.
"One of the best and most original games we have seen for the SPECTRUM so far" SINCLAIR USER.

Trade enquiries welcome at address below

NEW GENERATION SOFTWARE
FREEPOST (BS3433) Oldland Common, BRISTOL BS15 6BR
(no stamp required in UK)
or for **INSTANT CREDIT CARD** sales ring 01-930 9232
s.a.e. with enquiries please.

Please send me .....off 3D TUNNEL/ .....off ESCAPE, at **£4.95** each (inc p&p and VAT). I enclose cheque/P.O.

Mr/Mrs/Miss .....

Address .....

.....post code.....

YC01

SUTTON HOME COMPUTER FAIR '83

AT THE CENTRAL LIBRARY ST. NICHOLAS WAY, SUTTON, SURREY.

THURS 20TH JAN 9.30-8PM
FRI 21st JAN 9.30-8PM
SAT 22ND JAN 9.30-5PM

Fun for all the family:
Computers: Magazines: Books
Programs: Add-ons: Club Stalls:

DON'T MISS IT:

ADMISSION FREE

TRADE ENQUIRIES – 01-661 5027

H&H SOFTWARE

Some DRAGON versions available

Software for the BBC Computer

Model B only

ALPHABETA A complete Word Processing Package with instantaneous response. Features include automatic wraparound, insert, delete, over-write, title centring, tabs, merging and other editing facilities. Up to 224 lines of 80 characters can be produced. For longer documents editing between files is possible. Price includes a manual and labels for the red keys.....£28.50

BILLIARDS This is a game of skill and cunning. Key in the direction, pace and backspin on your cue ball and watch the result. The computer does the rest.....£8.50

TESS Are you bursting with imagination or flare for graphic designing or just wanting a completely different type of program? TESS is for you. Design a shape, choose colours, pattern and size, then watch the screen fill with copies of your design interlocking together. Animations are possible, the tape includes an example.....£8.50

Model A or B (Family games with sound and colour)

SHAPE and **RACE** For 6 year olds upwards. In SHAPE, a tracer bounces inside a blue box and rebounds off a hidden shape. Can you identify the shape before your opponent. The RACE is between a hare and a tortoise. First one to the flowers wins.....£5.50

SIGNALS and **MAGIC** Make up sums to reveal a hidden shape. Guess the shape to get bonus points. Complete a magic square to get promoted and hear the fanfare. The higher your rank, the better the fanfare. 3 levels of difficulty.....£5.50

Prices include cased cassette, instructions, postage etc.
Please send orders and cheques/PO/Transcash (No. 614 131 707) to:

H&H, Dept A, 53 HOLLOWAY, RUNCORN, CHESHIRE.

For further information please send S.A.E.

EDUCATIONAL SOFTWARE ZX81 (16K) AND SPECTRUM (48K)

INTERMEDIATE MATHS 1: 6 teach and test programs. Long Multiplication, Long Division, Highest Common Factor, Lowest Common Multiple, Fractions 1 (+ & −), Fractions 2 (X& −).

INTERMEDIATE MATHS 2: 6 teach and test programs. Areas, Perimeters, Simple Equations, Percentages, Sets, Venn Diagrams.

† **INTERMEDIATE ENGLISH 1:** Meanings 1, Meanings 2 (harder), Parts of Speech, Proverbs, Similes, Anagrams.

INTERMEDIATE ENGLISH 2: Idioms, Opposites 1, Onposites 2 (harder), Group Terms, Odd Word Out, Spellings.

* **"O" LEVEL FRENCH REVISION:** 3 teach and test Grammar programs, plus 3 comprehensive Vocabulary programs.

* **"O" LEVEL MATHS REVISION:** 1 teach and test program, plus 2 programs using generated question from the "O" level syllabus.

PRIMARY ARITHMETIC: Add, Subtract, Multiply and Divide. Numbers are in large size type. 3 levels. Enter the answer with units first.

* **EDUCATIONAL QUIZ:** 4 programs for the family. Questions on General Knowledge, Reasoning, English and Maths. All questions use RND function.

*Mark your order ZX81 or Spectrum. Cassettes marked * are not yet available for the Spectrum. † Intermediate English 1 is also available for the 16K Spectrum. £4.50 per cassette, or send s.a.e. for catalogue to: –*

ROSE CASSETTES
148 Widney Lane, Solihull,
West Midlands LB91 3LH

Our software has received good reviews in "Your Computer", "Educational Computing" and "Sinclair User" and is included in the MUSE Library of educational software.

JOYSTICKS

23.50 INC VAT & P+P

ZX Spectrum / ZX81

FOR ONE JOYSTICK AND INTERFACE MODULE

BUILT, TESTED & READY FOR USE

- ★ **NO SOLDERING,** interface module plugs into rear connector between ZX and Ram Pack, Printer etc.
- ★ **NO SPECIAL PROGRAMMING,** Joystick 1 simulates cursor movement keys 5 to 8 through interface module.
- ★ **IMMEDIATELY COMPATIBLE WITH ALL SOFTWARE** using the arrow keys for movement.
- ★ **TWO JOYSTICKS** connect via one interface module.
- ★ **EIGHT DIRECTION, SELF CENTRALISING ACTION** with integral 'FIRE' button.
- ★ **FREE 'VIDEO GRAFFITI'** program & full instructions.

IMPORTANT: Use will not invalidate your Sinclair guarantee.

FROM: MR/MRS/MISS

ADDRESS

SEND C.W.O. To: A.G.F. HARDWARE, Dept. YCR, 26 Van Gogh Place, Bognor Regis, West Sussex PO22 9BY

QTY	ITEM	ITEM PRICE	TOTAL
	JOYSTICK	7.54	
	INTERFACE MODULE	15.96	
ZX Spectrum ☐ ZX81 ☐ Please tick		FINAL TOTAL	

INTERNATIONAL CHALLENGE

* * * VIC 20 * * *

A programme for your unexpanded Vic 20

• • • 2.23 • • •

After 25,000 attempts in Sweden, 2.23 is the record
Can you beat it and become the international master?

• • • RUSH • • •

We have specially imported 1,000 copies of this new and original game, which will challenge your memory. Every split second is vital when you are chasing that elusive 2.23 record. And now we challenge you to take on the Swedes at their own game, but in English of course!

• • • BEAT THE RUSH • • •

Send £6.60 now to; CTS 8, Unit 1, Endeavour Works, 73a Shenley Road, Borehamwood, Herts.
Cheques/PO payable to KINGFISHER COMPUTER PROGRAMMES
The price includes VAT and P&P and official entry forms for this unique international challenge.

• • • P.S. • • •

Oh yes! When you've beaten the record, there are three further levels of play, to really test your memory, and each with its own record to break.

• • • P.P.S. • • •

And there's a free programme for every 25th order received.
So don't delay, send today and you could become the new European • • • RUSH • • • Champion.

KINGFISHER/CTS INTERNATIONAL CO-OPERATION

HILDERBAY

SPECTRUM SOFTWARE (48K)
PAYROLL (50 employees, all tax codes, pay levels, NI contributions; Hourly, weekly, monthly; payslips, summary of payments; Very easy to use; Amendments to employee details very easy right up to the last minute; Can also compute gross pay & deductions from net pay). £25

STOCK CONTROL (typically 1500 stock lines; prints list of all lines, or lines with given codes, or understocked lines; locate-by-name/add/delete stock line in under two seconds; prints values of stock. Program loads in one minute, data in less than three). £25

GOLD our best-selling adventure game, now available on the Spectrum! £8

ZX-81 SOFTWARE (16-48K)
BEAMSCAN. Computers bending moment and shear force diagrams for a simply supported beam with 1-99 point, uniform, and uniformly tapered loads. £25.
TIME LEDGER for up to 17 employees, 200 clients. A great time-saver! £15
OPTIMAX. A powerful linear optimisation program. Up to 75 variables. <, =, > constraints. £40
PAYROLL. Similar to the Spectrum version, but 30 employees. £25
STOCK CONTROL: about 400 stock lines in 16K, 2000 in 48K). £25
CRITICAL PATH ANALYSIS. Enter & solve 500-activity network in 16K. Edit durations & costs, & repeat. £15
BUDGET. Keeps track of expenses & compares them with budget. 50 headings, 12 months (I) or 12 categories (II). £15 for budget I & II (together)
FINANCIAL PACK I. Contains three programs: MORTGAGE, LOAN, VAT. £8

GOLD. A tantalising adventure game! £6

Do your programs load from tape first time, every time? If not, you need . . .

(1) THE MICROCOMPUTER USER'S BOOK OF TAPE RECORDING by Hilderbay Ltd.

Contents:
PART I (for everybody; the 'how to' part):
- How your system should work
- choosing a tape recorder
- testing and adjusting your tape recorder
- keeping your recorder in good condition
- the selection and care of tapes
- making reliable recordings
- loading 'difficult' tapes
- useful accessories.

PART II (more for enthusiasts; the 'why' part):
- how a tape recorder works
- computer cassette interface waveforms
- stereo heads, azimuth angle error
- miscellaneous tape problems.

Price £3.15 incl postage; £2.90 from bookshops. Or ask for it at your library.

(2) TEST AND ALIGNMENT CASSETTE: a precision accessory which enables you to set up the azimuth angle of your cassette recorder head accurately using only a small screwdriver! Azimuth error is one of the commonest causes of tape troubles. With full instructions. £4.90.

(3) LOADING AID: if your recorder is basically OK, but you have trouble getting the playback level right with tapes from different sources, you need our Loading Aid! Also suitable for checking the quality of tapes, detecting and (sometimes) compensating for dropouts, etc. With full instructions and hints on tape use. £5.95

(4) TAPE RECORDER aligned and tested for computer use. A simple, but satisfactory, machine. £22 + £2 postage
(All products suitable for most computers)

SPECIAL TAPE OFFER!
Book + alignment cassette + loading aid for £11.90!

Free program (ZX-81 or Spectrum) with all orders of £22 or over postmarked before 1 February!
All prices include VAT. Everything post free unless stated otherwise COD orders £2 extra. Access orders accepted by telephone.

Hilderbay Ltd
Professional Software
8/10 Parkway
Regents Park
London NW1 7AA Since 1979
Tel: 01-485 1059 Tlx: 22870 We have 20 years experience in computers

---

Why should games players have all the fun?

SUPERPLAN FROM VIDEO SOFTWARE LTD

For 48K ZX Spectrum
We take ZX computers seriously

Serious software which you will enjoy using

With SUPERPLAN you can put your ZX Spectrum to serious use in the home, school, club or small business.

Create and update an analysis sheet or spreadsheet within the Spectrum's 48K RAM.

Save the chart on cassette. View it using the TV screen as a window. Update it from the keyboard. Print it on your ZX printer (optional).

We have delayed advertising this product until now to ensure availability.

- Machine coded scrolling with user variable windows.
- Binary coded decimal arithmetic (BCD).
- Variable column width.
- Up to 52 columns.
- Chart capacity exceeds 40000 digits.
- Full colour display.
- "Flashing box" positioning under keyboard control.
- Arithmetic functions + - * / % (and one or two more).
- Audit trail of all entries.

VIDEO SOFTWARE LIMITED
Stone Lane, Kinver, Stourbridge, West Midlands.
Tel: 038-483 2462.

SAE for data sheet.

SUPERPLAN. The complete do-it-yourself analysis chart generator and processor. £12.

SUPERPACK 1. Four ready-made charts for business — sales daybook, purchase daybook, cash book and petty cash book. Complete with SUPERPLAN processor but without the generator. £7.

Cash with order for immediate delivery. Prices include VAT, P. & P.

Christmas space action with . . .

SPECTRUM

STORM-FIGHTERS

. . . explosive machine code thrills

They come from deepest space.

An alien fleet whose skill is matched only by its ruthlessness.

They hide and manoeuvre in the cover of asteroid clouds . . . showers of cosmic rubble that spell death on collision to the commander of the lone space ship that protects Earth.

You are that commander.

Your weapon is a twin firing laser canon. Double bolts of pure energy that mean instant annihilation to on-target aliens. It's responsive. It's fast. But only as fast as you are.

In one of the toughest challenges available for your Spectrum your mission is to destroy the aliens and avoid the asteroids before they destroy you.

Put yourself at the controls. On the thrilling edge of adventure . . . the STORM-FIGHTERS await you.

All machine code action . . . full colour graphics . . . full sound sync . . . progressive difficulty . . . comprehensive scoring . . . high value mother-ship . . . runs automatically on both 16K and 48K models:

Available on quality cassette at £4.95 (post free in U.K.) from

John Prince
29 Brook Avenue, Levenshulme
Manchester M19

Introducing... new from

YOUR COMPUTER CLASSIFIED ADVERTISING

From the February issue, Your Computer — Britain's largest selling home computer magazine is to introduce a classified advertisement section.

The introduction of this section opens up a new and exciting opportunity for advertisers to regularly, effectively and economically sell their products and services to the largest audience of potential customers offered by any home computer magazine.

It also provides an excellent "shop window" for private advertisers who wish to buy, sell or exchange equipment with other enthusiast readers of Your Computer.

To place a classified advertisement in Your Computer, simply complete and return the order form below.

SELL IT WITH YOUR COMPUTER

Classified Rates
Linage: 30p per word (Min 15 words) — prepayable

Linage advertisers should complete the form provided in BLOCK CAPITALS. Phone number counts as 2 words. Name and address to be paid for if used in advertisement. Box Number if required is £3.00 extra.

Display — rates per scc (Min 2scc)

One insertion	:	£7.00
Three insertions	:	£6.70
Six insertions	:	£6.50
Twelve insertions	:	£6.00

Display advertisers should provide separate copy and preferably reserve space by phone (01-661 3031).

Method of Payment
Cheques etc. should be made payable to IPC Business Press Limited and crossed "& Co" I enclose herewith cheque/PO for

£.....

Please debit my Access/Visa Barclay Card/American Express/Diners Club Int/ /as below

BARCLAYCARD VISA · ACCESS · AMERICAN EXPRESS · DINERS CLUB INTERNATIONAL

SIGNATURE

Post to:
Cut out the order form and return together with your remittance to: Classified Department, Your Computer, Room H211, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. (01) 611 3031

CLASSIFIED ORDER FORM

Please insert the following advertisement in Your Computer Classified Section

					LINAGE
					£4.50
					£6.00
					£7.50
					£9.00
					£10.50
					£12.00
					£13.50
					£15.00

No. of insertions required ☐ Box No. required YES/NO

NAME *(Please include initials).* .....

ADDRESS .....

.....

.....

Payment by credit card please state address card is registered

Daytime tel. no .....

THIS FORM SHOULD BE RETURNED BY JANUARY 10 FOR FEBRUARY ISSUE PUBLICATION

SINCLAIR COMPUTERS

UK prices are shown first. The bracketed prices are export prices which include insured air-mail postage to all the countries of Europe including Norway, Sweden, Finland and Denmark. For overseas customers outside Europe an extra £5 postage per item is charged.

zx81 £43.43 (£52). zx printer £52.13 (£61). zx spectrum 16K £152 (£160). zx spectrum 48K £202 (£210). zx microdrive n/a (n/a). zx rs232 n/a (n/a). 5 printer rolls £10.43 (£16). Ram packs: – 16K £26.04 (£31), 32K £39 (£41). 56K £49 (£51).

DRAGON 32 £173

COMMODORE COMPUTERS

Commodore 64 £299. Vic 20 £130. Kit to allow the use of an ordinary cassette recorder £6. Vic 20 cassette recorder £36.50. High resolution graphics £27.95. We stock most accessories.

GENIE COMPUTERS

New colour Genie £173.50, 16K ram card £44. Light pen £15. Accessories for Genie 1 and Genie 2:– EG3014 32K £189. Disc drives single £199, dual £369. Double density converter £72. High resolution graphics £82. Printer interface £36.

UK101 AND SUPERBOARD

32 × 48 display expansion kits UK101 £9, Series 1 Superboard £14. 32K memory expansion board £60. Cegmon £22.50. Word processor prog £10. Centronics interface kit £10. Cased disc drives with DOS single £275, double £415. Stand alone floppy disc controller £85.

PRINTERS

Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard. Epson MX80FT3 £330. Epson MX80T3 £310. Epson MX100/3 £429. Seikosha GP100A £189. OKI Microline 80 £235. OKI Microline 82A £333. OKI Microline 83A £446. OKI Microline 84A £742.

5V POWER KITS

Fully stabilised 5V computer and TTL power kits. 1.5A £7.83, 3A £12.17, 6A £20.87.

SHARP COMPUTERS

We can supply Epson MX80 and MX100 printers to run direct from the MZ80K (i/o box not needed) for £39 plus printer price. We also specialise in interfacing printers to the MZ80K, MZ80A and MZ80B both with and without the i/o box.

SWANLEY ELECTRONICS
Dept YC, 32 Goldsel Rd., Swanley, Kent BR8 8EZ.
Tel: Swanley (0322) 64851

Postage £1 on Sinclair products (UK), £3.50 on other computers, £4.50 on printers and 50p on other orders. Please add VAT to all prices. Official credit and overseas orders welcome.

NEW

From Warp Factor Eight

Lift-off into '83 with HI-STAK

ONLY £3·95 includes VAT, p&p

- makes your computing easier, faster, more reliable, less exhausting and simply more enjoyable.
- angles your computer neatly to the correct ergonomic position for the most efficient keyboard operation.
- provides extra ventilation for hot ZX81's and Spectrums.
- instantly applied.
- styled for '83, adds that professional look to your set up.
- precision injection moulded in quality ABS, non scratch – non slip base.

ZX81
SPECTRUM
VIC20
TRS80
NEW BRAIN
JUPITER ACE
Etc.

Order form. Please send me____HI-STAK set(s) (at £3.95 per set). I enclose cheque/P.O. for_____

Name_____

Address_____

_____

_____ Post code_____

To: Warp Factor Eight, Dept. YC.
6 Pelham Road, Braughing, Ware, Herts. SG11 2QU.

Battle of Britain

By Microgame Simulations for the Spectrum

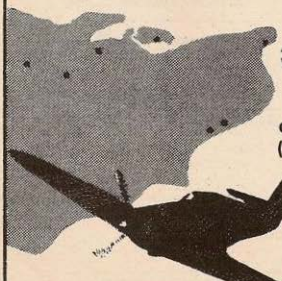
One day in summer, 1940. Reports are coming in of enemy bomber squadrons crossing the English coast; target unknown.

How are you to deploy the nine fighter squadrons under your command to intercept the incoming threat!

British and enemy squadron movements are plotted on a superb high resolution secreen map of south east England. with communications signals presented both visually and in morse code.

Features variable difficulty levels, full control of squadron movements, randomly selected targets and bomber routes for each game, intelligence reports, refuelling etc.

A tense game of strategy for one player.



48K Strategic Wargame

only £5.95 (inc. p&p)

MS

73 The Broadway, Grantchester, Cambridge CB3 9NQ

Salamander Software

PRESENTS SOFTWARE FROM THE SOUTH.

DRAGON:

STAR TREK
A full version of this classic game, for the Dragon; features Faery Queen, hyperprobe, time travel, tractor beams and more! Includes a 16pp Flight manual. 1 Joystick required. £6.95*

WIZARD WAR
The mighty mages of the Tri-suns strive for supremacy in a fearsome battle of skill and strategy! Joysticks required. £6.95

VULCAN NOUGHTS AND CROSSES
Pit your wits against the Dragon or your friends in this three-dimensional game of logic! Also features a zero player option. £5.95

GAMES COMPENDIUM
A selection of games for all the family, including Blackjack, Donkey Derby, Kingdom, Noughts & Crosses, Lunar Lander and Hunt the Wumpus! £6.95

BBC MODEL B:

DRAGON RIDER
Can you destroy the enemies from the sky before your fiery steed runs out of puff £6.95

TANKS!
Variable wind and terrain make this exciting two-player game a challenge for everyone £6.95

All games guaranteed. V.A.T. included in all prices. Add £0.50p for p&p.

Send cheque of P.O. payable to SALAMANDER SOFTWARE.
27 Ditchling Rise, E. Sussex. BN1 4QL.
Tel: 0273 686454

Discount for bulk orders and retail: send SAE for catalogue.

Programmers wanted — Good Royalties Paid!

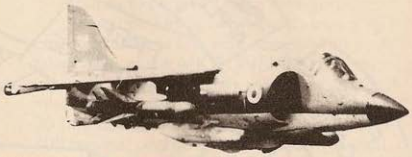
***Special Offer**

C ☆ TECH

Spectrum & Dragon Software

DRAGON

SEA HARRIER FLIGHT SIMULATOR



A high resolution Colour Sea Harrier Flight Simulator.
This program shows you a full colour view of the sky, ground and runway which move in 3 dimensions. Using your air speed indicator, artificial horizon and compass, all in HiRes colour in the lower part of the display, you must bring your Sea Harrier into land at Port Stanley runway.
£5.00

C ☆ TECH 184 MARKET STREET HYDE, CHESHIRE

SPECTRUM

VIDEO PACK
includes all of:—

- POLECAT maze video game
- CITY BOMBER
- BREAKOUT
- FRUIT MACHINE
- LUNAR LANDER
- CRAZY RACE
- SUBHUNT
- MISSILE COMMANDER
- SPECIAL PRICE

C ☆ TECH **£5.00** INC!
FOR ALL 8

SPECTRUM

16K OR 48K

ASTRO SCRAMBLE
£2.95

THE **ZX·16K·81** GAMES / £5-00 inc VAT + P/P
4 MAGNIFICENT MACHINE CODE GAMES ALL ON TAPE

SCRAMBLE
INVADERS
GALAXIANS
GUNFIGHT
+ 2 STRATEGY GAMES.

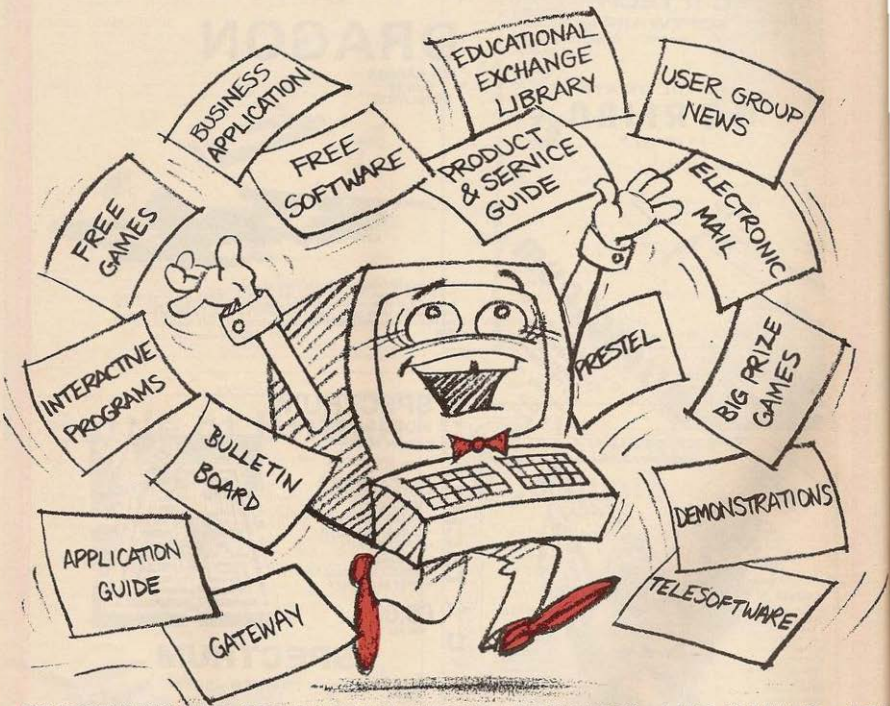
BBC

SOFTWARE
While stocks last!!

LUNAR LANDER
£4.00 INC

EARLY WARNING
£4.00 INC

MORE IDEAS THA
MORE PROGRAMS THA
LESS MONEY THA



PROGRAMS FOR EDUCATION, HOME, BUSINESS, AND GAMES – FOR SINCLAIR, BBC, RESEARCH MACHINES, APPLE, COMMODORE, ACT SIRIUS, TRS-80, IBM, ICL, and more each month. . .

HOW THE MICRONET 800 SERVICE WORKS:

Most micros connect by a standard DIN plug and coaxial cable to an adaptor. They're portable, so you can use the system wherever you put your computer and telephone.

Simply dial Micronet's number and enter your subscriber number into the keyboard. A 'welcome to Micronet' message appears on the screen.
You're on-line to one of the world's largest databases.

PRESTEL
MICRONET 800's
thousands of ideas – packed pages – games, education, business software, club news and information.

When you have all the information you need – or you've finished 'downloading' software to your computer's memory – just switch off the telephone link at your keyboard and replace the receiver.

N A THINK-TANK. N A SOFTWARE HOUSE. N YOU'D EXPECT.

Whether you bought your computer for games, business, or education, you can spend a lot of time wondering what to do with it. And then spend a lot of money on packaged games and applications software.

NOW you can bring your computer to life – economically – by joining the amazing new MICRONET 800 service: a vast database with hundreds of FREE games, plus business and education software, computer news, special offers and 'big prize' opportunities for you to compete against the system – and win!

MICRONET 800 is packed with ideas and information. And there's no waiting – you get programs straight down the phone line! Updates on operating systems . . . school and college programs . . . gobble man . . . invaders . . . business packages. They're constantly renewed. And hundreds of them are free: you simply turn on your micro, dial up MICRONET 800 and LOAD.

Sounds expensive? Here's the surprise!

All you pay for is a low-cost adaptor (in most cases just £49) to link your computer to your telephone, plus a MICRONET 800 subscription of about £1 per week. Then, via your computer and telephone line you will be able to access over 30,000 ideas-packed 'pages' of the MICRONET 800 service, and call down the software you want to your own computer! Look at just a FEW of the services already available on Micronet for you to call on:

- **Free Telesoftware:** Indexed by subject and by name of micro, a huge selection can be loaded down onto your computer.
- **Educational Exchange Library:** Schools and colleges are already preparing to display programs written by students and teachers, so many can benefit from them easily and economically.
- **Applications Guides:** Quick-reference guide by subject and by micro name shows you available applications software. You can move from the guide to further details held on the system if you wish.
- **Demonstrations:** Check through the features of the software packages that interest you – privately and without obligation. Order only if you're sure it's what you need.
- **Purchase 'Downloadable' Software:** Many 'telesoftware' programs can be bought from the system and loaded down direct to your micro. But don't worry – there's plenty of warning if any MICRONET service you're planning to use carries a charge.
- **Electronic Mail:** A mailbox service on Prestel allows you to exchange messages with other Prestel or Micronet users. Messages are held securely and only you can collect them.
- **Bulletin Board:** For an additional subscription you can operate your own bulletin board – club news, for example, like tips, swap-shop for second-hand items and so on.
- **Phone-In:** If you're away from your computer but need to send a message to another Micronet user – call the Micronet 800 service by phone and we'll send the message for you.
- **Prestel:** Over 200,000 pages of information on British Telecom's established service. Facts and advice on finance, business, entertainment, features and even direct bookings for travel, holidays, etc.
- **Product and Service Guide:** A constantly updated reference source – covering product comparisons, software reviews, dealership and price details and all the 'best buy' information.
- **Action Advertising:** Includes features, just like a magazine, including jobs and classified ads. If you've read an article that interests you, through MICRONET you can find out about the manufacturer, the dealers, the prices, and even order the product via your micro!
- **User Group News:** The Amateur Computer Club and many others like ALCC, BASUG, ICPUG, TUG, TRS 80 UG, will maintain their news and reference service on Micronet.
- **Big Prize Games:** Micronet offers a range of games and quizzes to keep you entertained and involved – and there'll be big prizes too!

SOUNDS FANTASTIC? THAT'S JUST THE START!

MICRONET 800 is a completely new service and we'll be adding to it all the time. Find out more about what Micronet 800 has in store for you: return this coupon TODAY and we'll send you a FREE FACTS FOLDER on Micronet 800 services and details of how you can join!

micronet 800

IT BRINGS YOUR COMPUTER TO LIFE!

Send to: MICRONET 800, Petersham House, 57a Hatton Garden, London EC1B 1DT.

YC1

☐ Yes, I am interested in the MICRONET 800 service. Please keep me in touch with developments and send me details of the low-cost Micronet 800 adaptor.

☐ I am interested in earning money on software I develop for the system.

I am interested in: Home uses ☐ Business uses ☐ Educational uses ☐

Name _____

Address _____

_____

_____ Telephone _____

Type of computer _____

POST TODAY

CONVERT YOUR ZX....

FULLER MICRO SYSTEMS ADD STYLE, POWER, VERSATILITY AND FULL TYPEWRITER KEYBOARD OPERATION TO ZX81 AND ZX SPECTRUM!

FULLER FD42 SYSTEM – The ideal Christmas Gift for ZX81 users!

The ZX81 is easily Britain's best selling small computer, and now costs an incredibly low £49.95. To celebrate this event, we are offering our equally popular FD42 system at an even lower price than before! It converts your ZX81 into a sturdy, attractive and professional unit, with full sized typewriter keyboard. **NOW ONLY £29.95** (plus £2.50 p & p)

ITS EVEN CHEAPER IN KIT FORM!

FD42 Keyboard and Case Kit _____ **JUST £24.95** (plus £2.50

FD42 Keyboard Kit _____ **JUST £14.95** (plus 80p p & p)

OR WHY NOT BUY A COMPLETE SYSTEM!

If you are not lucky enough to already own a ZX81, an FD42 System, including computer, from us, and make an even bigger saving! ZX81, FD42 Keyboard and Case with power supply, reset switch, leads and manual – True Value £79.95.

SPECIAL OFFER £69.95 (plus £2.50 p & p)

FULLER MEMORY EXPANSION – a massive boost for your ZX81!

The basic ZX81 has only 1K of RAM – now you can add on an enormous 16K with our FD 16K Memory Module. FD 16K to mount on the back of ZX81 or Fuller Case.

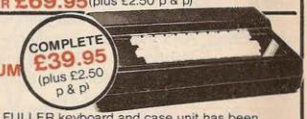
_____ **£24.95** (plus 80p p & p)

FD 16K to fit inside Fuller Case, complete with RAM adaptor board. _____ **£29.95** (plus 80p p & p)

FD 64K to fit inside case (incl RAM adaptor board) **£69.95**

FD 64K to mount on back of ZX81 or FULLER CASE **£64.95**

FULLER FD SYSTEM for ZX SPECTRUM



Now, the famous FULLER keyboard and case unit has been adapted for Britain's fastest selling colour computer – the amazing ZX Spectrum! it has the same high standard as the ZX81 unit, a tough plastic case encloses the keyboard, Spectrum P.C.B. and power supply. The Keyboard has 42 keys including all the Spectrum graphic characters printed on to them, the full travel key switches have gold plated contacts and guaranteed life of 10^6 operations.

IT'S SO EASY TO INSTALL! You simply unscrew the ZX P.C.B. from its case, screw it to the FD case, and plug in the keyboard. No soldering or technical knowledge required.

COMPLETE UNIT _____ **£39.95** (plus £2.50 p & p)

KIT FORM _____ **£33.95** (plus £2.50 p & p)

FULLER SOUND EXPANSION – a superb addition to your ZX Spectrum!

Clear, dynamic sound effects will really enhance your enjoyment of the new, exciting programs available for the sensational ZX Spectrum. Our new sound box comes complete with leads, volume control and loudspeaker. Just plug it into your MIC input, and it fits neatly onto the back of the Spectrum in a tough, plastic case.

_____ **JUST £6.95** (plus 80p p & p)

NEW! Programmable Sound Generator – adds exciting new sounds to the Spectrum range.

ONLY £19.95 (plus 80p p & p)

SPECTRUM MOTHERBOARD

Fits inside the Fuller case, allowing expansion to the ZX memory and 1/0 facilities.

2 SLOTS _____ **£15.95** (plus 80p p & p)

3 SLOTS _____ **£19.95** (plus 80p p & p)

STOP PRESS! 16K Spectrum owners – upgrade to 48K with a Fuller Spectrum Upgrade Pack – complete with full assembly instructions. **£34.95** (Inc p & p)

SEPARATE SPECTRUM P.S.U.

9 volts DC at 2 amps.
Mains either 110v or 240v A.C. _____ **£5.95** (plus 80p p & p)

FULLER ZX Spectrum Software

So little software is available for the Spectrum, you could count on Fuller to be one of the first! Startrek, Flight Simulation and Death Star, all in attractively packaged cassette form.

_____ **£5.00** (plus 50p p & p)

SPECTRUM PLUG PLANNER

A useful combination of 9v @ 2 amp power supply and three 13 amp sockets for computer and peripherals. Complete with 3 metres of cable and power jack to fit Spectrum or ZX81. _____ **£18.95** (plus £1.00 p & p)

Fuller MICRO SYSTEMS

Mail to: **FULLER MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2.
Telephone: 051-236 6109

Please supply the following items:

ITEM	QUANTITY	PRICE	POSTAGE	TOTAL

I enclose cheque/p.o. ☐
Or, please debit my Access/Barclaycard No. _____
Name _____
Address _____
_____
Please send me further details, I enclose S.A.E. ☐

Y.C.1.83

SOFTWARE FOR BBC TRS-80 AND GENIE from DAVANSOFT

Win the Pools?
With the latest version of D S Peckett's well-known Pools Prediction program. Now available for BBC Micro (needs 32K memory) as well as the TRS-80 (LII) and Video Genie.

Program and instructions	£4.95
Database tape (optional, but holds data on over 6500 matches)	£13.50
Program and DB toegther	£17.50

baby PILOT
Easy-to-use, friendly and very fast version of this important teaching language. Normal PILOT commands PLUS arithmetic, graphics, loops and other extra featues.
baby PILOT (TRS-80 and VG only) £9.95

TRS-80/VG Shift-Lock
Avoid the irritation of holding-down the shift key to enter lower-case. Adds 2 new commands to Level II BASIC to make the keyboard work like a typewriter, or switch back to normal.
Shift-Lock (must have l'case h'ware) £3.95

BBC Disassembler
Now — A full 6502 disassembler, with automatic labelling, and with the ability to avoid data areas. Optional dumps to printer and/or tape for later study, modification and LOADing.
BBC Disassembler £5.95

BBC Character Builder
Makes it easy to re-define characters for the Beeb's VDU 23, command. Create characters on the screen and save them directly as lines of program — essential to the keen BBC programmer.
Character builder £4.95

BBC Tape-Copy
Worried that you cannot make safety copies of valuable BBC machine-code tapes? This program will back-up any standard format machine-code tape, complete with start address, etc.
Tape-Copy (32K only) £7.50

All these prices are fully inclusive and are for cassette-based programs only.

DAVANSOFT
1 Delapoer Drive, Haverfordwest, Dyfed, SA61 1HX

We are always looking for high-quality programs for TRS-80, VG and BBC computers, and will pay up to 30% royalties for suitable material. Please contact us with your proposals or for details of our requirements.

SPECIAL OFFER
ON
ZX-81 & SPECTRUM ADVENTURES

MINES OF SATURN: — "While piloting a routine orbit of SATURN, you are caught up in a radiation storm which forces you into the giant planet's rings. Your energy drained, you make a forced landing on the planet surface. Luckily you crash near an abandoned mining base and you set off in search of some Di-Lithium crystals to refuel your stranded space-ship. Can you succeed?
BE WARNED — THIS IS NOT EASY.
RETURN TO EARTH: — "Having escaped from your previous dilemma, you reach Earth Station 1, but fail to make radio contact. You effect a safe if harrowing manual docking with the orbital station. On entry you find it deserted, and the control room destroyed. You must explore the station and find some way to alert Earth of your predicament, BEWARE, many of the rooms are identical, there is extensive damage, and signs of Alien intruders.
(The sequel to MINES of SATURN).
SPECIAL XMAS OFFER £7.50.
FOR BOTH GAMES POST AND PACKING FREE.
(Programs run on 16K & 48K machines. Offer valid till 31st. JANUARY 1983).
Send now for this fabulous offer, double saved on computer quality cassettes, and despatched by return of post (1st. class letter), you won't be disappointed.
PLEASE SPECIFY ZX-81 or SPECTRUM VERSION
Please make cheques etc. payable to:

SATURN DEVELOPMENTS LTD
37 Heol Dulais, Birchgrove, Swansea SA7 9LT

COMING SOON, our exciting 1983 catalogue of Sinclair Software, SAE please.

HOME/ PERSONAL/ BUSINESS/ SCHOOL

Announcing:

THE DRAGON 32

Database management Filing System

The Program — That everyone can use!

Extensive facilities include Add Records. Change Records. Delete Records. Set up Records. Sought Records. Find Records. Calculations. List Records. Print Records. Summarised Records.
Save File on Cassette (up to 500 records).

The Program . . . comes with comprehensive documentation and is recorded on both sides of a computer quality C15 Computer Tape. A demonstration File is also included on the tape.

Only £19.95 (fully inclusive)

Other Dragon titles include Mail List, Stock Control, Business Accounting, Bank Accounting, Invoices and Statements

*** Special Offer ***
All six programs £39.95
Access and Dealer Enquiries welcome 03952 5832

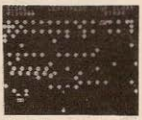
GEMINI MARKETING LTD
9 Salterton Road, Exmouth, Devon EX 8 2BR

NEW! # ATOM **NEW!**

ALL ACTION PACKED M/CODE ARCADE GAMES

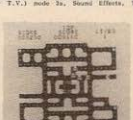
PROTECTOR £7
The most realistic version of this amazing Arcade game available for the Atom. Defend your humanoids from mutation and destroy the Aliens in this hyper fast, action packed game. Moving planetary surface, repeating lasers and smart bombs, thrust, space, increasing Attack Waves, 4 types of Aliens, Sound Effects, Top score and excellent mode 4 graphics are some of the features in this exciting game.

CENTIPEDE £6
The first and only version of this popular Arcade game for the Atom. Shoot down the spitting centipede as it swirls through the mushroom field. Also inhabiting the game are Spiders, Bugs and Snails. The action increases until only skill and quick thinking can save you. Excellent high speed mode 4 graphics, Sound Effects and Top score.



OMEGA MISSION £7
The first and only version of the superb Scramble Arcade game. Moving landscape! fly over mountains, through caves and tunnels. 3 different stages. Ground to Air Missiles, Flow Bulls, Space Craft, Mutants and the narrow twisting Tunnel. Movement in 8 directions, laser cannon; Excellent COLOUR graphics (give Black & White on monochrome T.V.) mode 3a, Sound Effects, Top score.

PUCKMAN £5
One of the best versions of this popular Arcade maze chaser game. Eat all the dots in the maze but watch out for the hungry ghosts! Eat an Energy Blob and the chase reverses. Each maze cleared brings a new one with faster ghosts. Excellent high speed mode 4 graphics, Sound Effects and Top score.



ALL 12K RAM

PRICES INCLUDE P&P. FAST 2 DAY DESPATCH!

micromania
14 LOWER HILL RD. EPSOM. SURREY.

PROFESSIONAL SOFTWARE

Wiley Professional Software

«Because you didn't buy a computer to practice your typing»

We are pleased to be able to announce the first software packages produced by John Wiley & Sons Inc. They are designed to accompany Computer Titles from the self-teaching guide series.

BOOK/DISC COMBINATIONS

- Practical manuals that show you how to program your micro for business, learning, and pleasure.
- Convenience disks that contain all the programs and subroutines in the books they accompany—error free and ready to run.

PLUS the Wiley expertise that has helped more than a million people learn how to program, use, and enjoy microcomputers.

☐ **APPLE™ BASIC: DATA FILE PROGRAMMING SET**
LeRoy Finkel & Jerald R. Brown

How to program and maintain data files for billings, catalogs and lists, numerical and statistical data, and much more. Includes one 5¼" disk for Apple II™. (Requires one 16 sector disk drive, 32K of memory.)
0471 86836 X **£13.50**

☐ **THE TRS-80™ MEANS BUSINESS SET**
Ted G. Lewis

Covers file merging, data base, word processing, payroll, financial analysis, and scores of other business applications. Includes one 8" disk for TRS-80™ Model II. (Requires two disk drives, 64K of memory.)
0471 86798 5 **£13.50**

☐ **GOLDEN DELICIOUS GAMES FOR THE APPLE™ COMPUTER SET**
Howard M. Franklin, Joanne Koltnow, & LeRoy Finkel

Step-by-step instructions for designing game programs that turn your Apple II™ into a home entertainment center — whether you're a novice, intermediate or advanced programmer. Includes two 5¼" disks for Apple II™. (Requires one 16 sector disk drive, 32K of memory.)
0471 86836 1 **£23.70**

☐ **FAST BASIC: BEYOND TRS-80™ BASIC SETS**
George A. Gratzer with Thomas G. Gratzer

Learn a streamlined form of BASIC that accelerates computations by 3 or 4 times . . . and some functions by a factor of 1,000.

Available in disk or cassette for TRS-80™ Model I or Model II. (requires 32K of memory.)

☐ 0471 87484 1 Model I Disk Set (one 5¼" disk) **£13.50**
☐ 0471 86838 8 Model III Disk Set (one 5¼" disk) **£13.50**
☐ 0471 87421 3 Cassette Set for Model I or Model III **£13.50**

TRS-80™ is a trademark of Tandy Corp. Apple™ is a trademark of Apple Computer, Inc.

Look for these at your favourite bookshop or computer store. Or, check the sets that interest you and write to us at the address below.

John Wiley & Sons Limited
Baffins Lane · Chichester · Sussex PO19 1UD · England

CAN YOU FILL THIS SPACE ?

ARCADE ACTION

SOFTWARE PROGRAM WRITERS

If you can fill this space with one of your own programs written on one of the following models: SPECTRUM ZX81, VIC 20, DRAGON, ATARI, BBC and any other makes of home computer, and wish to work with one of Great Britain's most progressive companies then ring David Heelas, for an early discussion.

23 Sussex Road, Gorleston, Gt. Yarmouth, Norfolk Tel: (0493) 602453.

dk'tronics

MICRO POWER GIVE A GREAT DEAL MORE

** SPACIOUS SHOWROOM OPEN MON. to SAT.
*FRIENDLY AND HELPFUL STAFF
*EXPERT ASSISTANCE ALWAYS ON HAND
*GOOD RANGE OF COMPUTER BOOKS
*AFTER SALES TECHNICAL BACK-UP and SUPPORT

ACORN ATOM

SPECIAL OFFER (While stocks last)

Built & Tested ATOMS	
Basic (8K Rom + 2K Ram)	£117.50
Expanded (8K Rom + 12K Ram)	£142.50
Disk Packs (inc. FREE Buffer Kit)	£299.00
ATOM CALC ROM	£34.00
WORD PROCESSOR ROM	£26
FLOATING POINT ROM	£20
ROM SELECTOR BOARD	£19.50
BBC BASIC (phone for availability)	
Full Range ACORNSOFT programs	
BOOKS	
Getting Acquainted with your Acorn Atom	** £6.45
39 Tested Programs for the Acorn Atom	£6.45
Atom Magic Book	£5.50

BBC MICRO

MODEL A	£283
MODEL A (32K)	£311
MODEL B	£347
DISKS & INTERFACES (phone for availability)	
14 Inch Colour Monitor	£269
20 Inch Colour Monitor	£299
BOOKS BBC Micro Revealed	£7.50
Basic Programming on the BBC Micro	£5.95
Let Your BBC Micro teach you to Program	£6.45
NEC '30 Hour BASIC'	£5.50
Practical Programs for the BBC Micro and Acorn Atom	£5.95
ACORNSOFT programs for the BBC MICRO	
PRINTERS	
– EPSON MX80 F/T III	£359
– EPSON MX80 T III	£315
– SEIKOSHA GP 100A	£199
Printer Leads (BBC/ATOM/NASCOM)	£18.50

NEW *FROM MICRO POWER*

DRAGON 32

THE FAMILY COMPUTER TO FIRE YOUR IMAGINATION

Easy to Learn! Easy to Use!
Colourful! Graphic! Musical!
Well-made and Designed to Grow!

KEY FEATURES

** 32K RAM as Standard, Expandable to 64K
** Display:
9 colours available.
5 different resolutions from 16 x 32 to 256 x 192.
** Extended MICROSOFT Colour Basic as Standard.
Advanced graphics commands—set, line, draw, circle, paint, print using:
Advanced Sound
Full Editing—insert, delete, amend.
** Professional Typewriter Keyboard (Guaranteed for 20 million key depressions).
** FREE 160 page 'BASIC' training manual.
** Simple 'plug-in' Connections for Joysticks, Printer, Games, Cartridges and 'auto-controlled' cassette.
** Software on Cartridge and Cassette already available (send for details).

PRICE ONLY £199.50 incl. V.A.T.
MAIL ORDER – £7 Carriage but FREE on cash/cheque orders.

THINK DRAGON !!
THINK MICRO POWER!!

FREE DRAW
WIN £100
Order a DRAGON from MICRO POWER before 31st DECEMBER 1982, and get FREE ENTRY into our CHRISTMAS DRAW!! TWO FIRST PRIZE £100 cash. TWO PRIZES for RUNNERS UP of a FREE PROGRAM CASSETTE

Please Add 15% VAT to all items except books.
Post & Packing 55p/order.
Large Hardware Items £7.00 Carriage

VISA

MICRO POWER LTD.
8/8a REGENT STREET,
CHAPEL ALLERTON,
LEEDS LS7 4PE.
Tel: (0532) 683186

ZX KEYBOARD

Our new cased keyboard has 52 keys, 12 of these are used for the numeric pad. The numeric pad offers some useful features; you can cursor with one hand and it will be a boon for anyone who enters a lot of numeric data.
The case measures 15 × 9 × 2½.
The computer (ZX81 or spectrum) fits neatly inside. Also fitted inside the case is a mother board (81 model only) which allows 16K, 32K and 64K to be fitted in the case. All the connections are at the rear of the case i.e. Power Mic, Ear, T.V. and the expansion port. The power supply could also be fitted inside. This means you have a very smart self-contained unit.
NOTE
The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute job and requires no electronic skills or any soldering.

4K GRAPHICS ROM £29.95

The DK Graphic module is our latest ZX81 accessory. This module unlike most other accessories fits neatly inside your computer under the keyboard.
The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you an unbelievable 448 extra pre-programmed graphics, your normal graphic set contains only 64. This means that you now have 512 graphics and with their inverse 1024. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines, in the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.
THE FOLLOWING SOFTWARE IS AVAILABLE FOR USE WITH THE GRAPHIC ROM @£4.95each
✱ASTEROIDS ✱CENTIPEDE ✱DEFENDER
✱SPACE INVADERS ✱METEOR STORM

ZX81 ARCADE SOFTWARE

THE FOLLOWING EXCITING MACHINE CODE ARCADE ACTION GAMES ARE AVAILABLE FOR THE 16 K ZX81
✱CENTIPEDE ✱METEOR STORM
@£4.95each

Fully cased with numeric pad £45
Uncased with numeric pad £30
Case £15

- ★16K Ram Massive Add On Memory Fully assembled and tested £19.95
- ★64K Memory Expansion £49.95
- ★4K Tool kit full of utilities to aid the programmer in constructing and de-bugging E.Prom version for use with graphics Rom £9.96 Cassette Version £6.95
- ★Flexible ribbon connector £10
- ★Spectrum Memory Upgrade to 48K £35

SEND S.A.E. FOR INFORMATION PACKED CATALOGUE

WHY WAIT?
ORDER TODAY FOR FAST DELIVERY

Please state type of machine which ROM/memory size quantity and price when ordering

Please send me ..... @£ .....
Please send me ..... @£ .....
Please send me ..... @£ .....
Please send me ..... @£ .....
Please send me ..... @£ .....
Please add on £1.75 for P/P. I enclose £

Name .....
Address .....
.....
Cheque/P.O. payable to DK Tronics

dk'tronics

23 Sussex Road,
Gorleston,
Great Yarmouth,
Norfolk.
(0493) 602453

Send off the coupon today or telephone Gt. Yarmouth for our answering service (available 24 hrs. a day 7 days a week) quoting Barclaycard or Access number).
Please add on £1.25 for P/P

ACCESS BARCLAYCARD VISA

abacus electronics

ZX 81 Spectrum

MONEY BACK GUARANTEE
CASSETTES DESPATCHED
WITHIN 48 HOURS

ABACUS CONTROLLER

Of all the Spec H/W items I have received this one most impressed me and its the only one I shall always use.

Developed to eliminate tedious swapping of plugs when LOADING or SAVING programs on cassette.
ZX SPECTRUM CONTROLLER: Single switch selection of SAVE, LOAD & AMP modes. Built in amplifier and loudspeaker boosts Spectrum sound output. Price **£14.95**
ZX81 CONTROLLER: Single switch selection of TALK, SAVE, CUE & LOAD modes. Built in microphone/speaker for fast and reliable program naming and cueing. Price **£9.95**

All items in this advertisement can be viewed before buying at the Buffer Micro Shop, London, and Jay Dee Communications, Water Street, Port Talbot.

AVENGER

AVENGER: This all action arcade-style game written in MACHINE CODE for the ZX Spectrum is fantastic! You are flying over a mountainous planet terrain. Your mission is to attack, using lasers and bombs, launch pads, buildings and missile silos. Alien craft attack you with missiles; guided missiles launched from the ground hunt you out. But what ever you do don't hit the atomic power stations!! Continuous display of time, score, shields and laser temperature. Five levels of play and high scores.
Price **£4.95** inc. Also available for the ZX-81 (16K) at **£4.95** inc.

SPECTRUM GAMES PACK 1

All four on one cassette at the incredible price of **£4.95** inc.

DESTROYER: Listen to the beeps of the sonar to locate and destroy the submarines before they sink the merchant ships.
ICEBERG: Steer your icebreaker through thickening pack ice to pick up survivors.
BATTLE: Destroy missile sites while avoiding mines and the computerised enemy tanks that are out to get you.
ANDROID PIT RESUCE: Rescue the miners before they are trapped in the flooding mines.

Access

186 St. Helens Ave,
Swansea, W. Glam.
Tel: (0792) 50282

A
ACS Software 92
AF Software 53
AGF Hardware 133
Abacus 11
Acorn Computer 26
Acornsoft 129
Adda 105
Amba 128
Amber 74
Amersham Software 7
Anirog 105
Audio Computers Inside Back
Auto Mata 125

B
Beebug 125
Bi Pak 146
Bibi 180
Bridge Software 92
Bug Byte 20, 21

C
CCS 116
Cabel 70
Calpac 115
Cambridge Micro 68
Campbell 108
Century Publishing 33
Chromasonic 32
Cloyvale 80
Compselect 128
Computer Rentals 102
Computer Smith 132
Comserve 122, 123
Crystal Computcrs 181

D
DKtronics Inside Front Cover 143, 145
Davansoft 141
DJL 128
Downsway 77

E
East London Robotics 102
Econotech 112
Educare 130
Eklan Electronics 95
Electronics Applied 95
Epson 19

F
Folkdale 84
Fuller Design 140

G
G.C.C. 106
Gemini Software 141
Gemini Marketing 10
Georges 90

H
H & H Software 133
Hewson Consultants 48
Hilderbay 134
Hisoft 181
Hopesoft 129

I
I J K Software 71
Imagine Software Back Cover
Impact Software 70
Intertext 106

J
J K Gosden 120
J K Greye
J R S Software 76, 82
Jade Computers 15
John Prince 134
John Wiley & Son 4, 142
Jupiters Micro Computers 8, 9

K
Kayde 120
Kempston Micro 90
King Fisher 133

L
Laserbug 181
Learned Information 30
Level 9 125
Linsac 128
Llamasoft 11
London Borough of Sutton 132

M
M C Associates 84
Macronics 146
Maplin 12, 13, 105
Melbourne House 14, 17
Memotech 126, 127
Michael Orwin 74
Micro Mania 141
Micro Power 124, 144
Microware Leicester 68
Micro Games Simulations 136

N
National ZX Club 43
New Generation 132

O
Oric Products 24, 25
Oxford Computer Publishing 86

P
P D Q Software 105
P S S 18
Picturesque/Addictive Games 87
Pixel 120
Prentice Hall 66
Print And Plotter 38
Pro Software 129

R
R O Labs 95
Redditch Computers 112
Richard Sheperd 77
Rose Cassettes 133

S
S W Winter 181
Salamander 136
Saturn Developments 141
Severn 132
Silver Soft 16
Sinclair Research 22, 23
Sir Computers 106
Softek 100
Software Farm 130
Software for All 49
Software Supermarket 82
Stork Rose 36
Sunshine Publishing 92
Superior Software 87
Swanley 136

T
Tangerine 60
Tarus 112
Timedate 86
Transform 82
Twickenham Computer Centre 112

V
Video Software 134
Visionstore 44, 45

W
Warp Factor 8 136
Watson 130
William Stuart Systems 80
Workforce 122

Y
Your Computer Classified 135

THE REAL INVESTMENT

NEW:
THE X-ROMCARD

FOR YOUR ZX81

WHAT IS *SO* SPECIAL ABOUT THE SPECIAL RAMPACK?

fig. 1

fig. 2

WHAT IS SO SPECIAL ABOUT AUDIO'S 16K SPECIAL RAM PACK?

THE SPECIAL RAM PACK (16K) is the latest design of its kind, following at least a dozen similar products. It has many of the good points of its predecessors, including packs manufactured by **Sinclair Research, Memotech, Bygbyte** and **Econtech** to cite a few of the best known.

With the experience we have gained with memories both for the **ZX 81** and a **wide range of other Micros**, we are also able to offer some **exclusive new features:**

THE CASE: **The SPECIAL RAM PACK** has been designed to overcome the infamous **'wobbling'** problem associated with many other packs, and does not resort to **temporary solutions** such as **Velcro, Blutak, adhesive strip** or a huge, unsightly case. It clamps positively to the ZX 81 by means of a special built in ridge aided by a **resilient spring effect** in the connection socket (see figure 1).

EXPANSIBILITY: **The SPECIAL RAM PACK** is not only compatible with all software and hardware produced for the **ZX 81**, such as the **ZX printer**, but it also has the edge over other packs with its **expansibility**. You will find it interesting that the **keyboard sounder** option is already included in the **SPECIAL RAM PACK**. It also has **expansion pins**, ready to receive — **in the same case** — the most advanced add-on ever designed for the ZX 81 — **the X ROM CARD** (see figure 2).

WHAT DOES THE X-ROM CARD OFFER?

1. **The X-ROM CARD has a built in autostart ROM.** Programs can be run automatically every time the ZX 81 is switched on. This will result in a huge increase factor for **ROM based software**, since all software houses are currently very aware of copyright piracy problems.
2. **The X-ROM CARD has a built in printer interface,** necessary if you wish to use a printer other than the XZ printer. **This is invaluable for any serious applications**, including **word processing**, where careful presentation is of the utmost importance.
3. **The X-ROM CARD has a built in EPROM burner.** This means that you can save Basic or Machine code programs onto silicon chips and play them back at any time.
4. **You may of course buy the X-ROM CARD to use with other Ram Packs** such as the **Sinclair Ram Pack**. However, when you purchase the X-ROM CARD with the SPECIAL RAM PACK, you will have the advantage of lower cost, greater reliability and neatness, since the whole system is nicely housed within a single case.

IN CONCLUSION, **The SPECIAL RAM PACK,** is the **best immediate investment** for your **ZX 81**. The availability of the **X-ROM CARD** opens the way to new software development such as **languages programming** and is the guarantee that your system will never be obsolete.

THE BEST GUARANTEE THAT YOUR ZX81 WON'T BE OBSOLETE FOR ONLY:

£ 19 .95

including VAT

TECHNICAL SPECIFICATIONS:

- SPECIAL RAMPACK:
  - **Memory capacity:** 16K bytes.
  - **Maximum speed:** 200 ns access time.
  - **Power requirement:** Use exclusively Sinclair PSU.
- X-ROMCARD:
  - **Autostart ROM:** 4K byte, exchange for 8K bytes and software switch possible.
    Displays memory size, checks for byte "00" (identifies ZX basic) @ 2000H.
    Loads program if found, checks for byte "C3" and jumps (2000H) if found.
    Checks for presence of ROM in socket n.3 and ROM catalog, displays catalog if found. Contains also machine code monitor and printer utility.
  - **Preprogrammed ROM:** Catalog available on request. Use only 2732 or 2764 ROM/EPROM.
  - **Blank EPROM:** Use only 2764 — 8K bytes per device — in socket n.3. 3 × 9V, PP3 size batteries are needed to burn EPROM.
  - **Printer connection:** 16 pin DIL output, use standard IDC ribbon cable. Outputs include DO to D7, Strobe, Reset, Inputs include No-fault and Busy.
  - **Documentation:** Schematic diagram included, full listings of Autostart ROM extra (only for X-ROMCARD user, £1.50 + large SAE)

AUDIO-COMPUTERS

87 BOURNEMOUTH PARK ROAD,
SOUTHEND ON SEA — ESSEX SS5 2JJ

THE REAL INVESTMENT

SOLIDISK TECHNOLOGY LIMITED

87 Bournemouth Park Road, Southend-on-Sea, Essex SS2 5JJ. Tel: 0702 613981

Item	Qty	Price Inc VAT	Total
SPECIAL RAMPACK 16K		£19.95	
X-ROMCARD		£14.95	
Preprogrammed ROM		free	
CATALOG		£ 9.95	
BLANK EPROM 2764		£ 1.00	£ 1.00
Postage and packing			
Please charge my Access, Barclay account:		TOTAL £	

*Please delete/complete as applicable
*I enclose cheque/P.O. payable to: SOLIDISK TECHNOLOGY LTD for £

NAME

ADDRESS

IMAGINE

a company brought into being by top professional programmers, graphic designers and software marketing specialists.

A company dedicated to the highest quality software and customer service in the world.

ARCADIA

the name of the game especially created to be the fastest, meanest, most addictive shoot 'em up game you've ever desired. Wave after wave of the most loathsome and deadly aliens billow hypnotically towards your space fighter with deadly intent. But then you have dual Plasma Disruptors and an Ion Thrust Drive haven't you? . . .

ZXSPECTRUM

(16K or 48K)

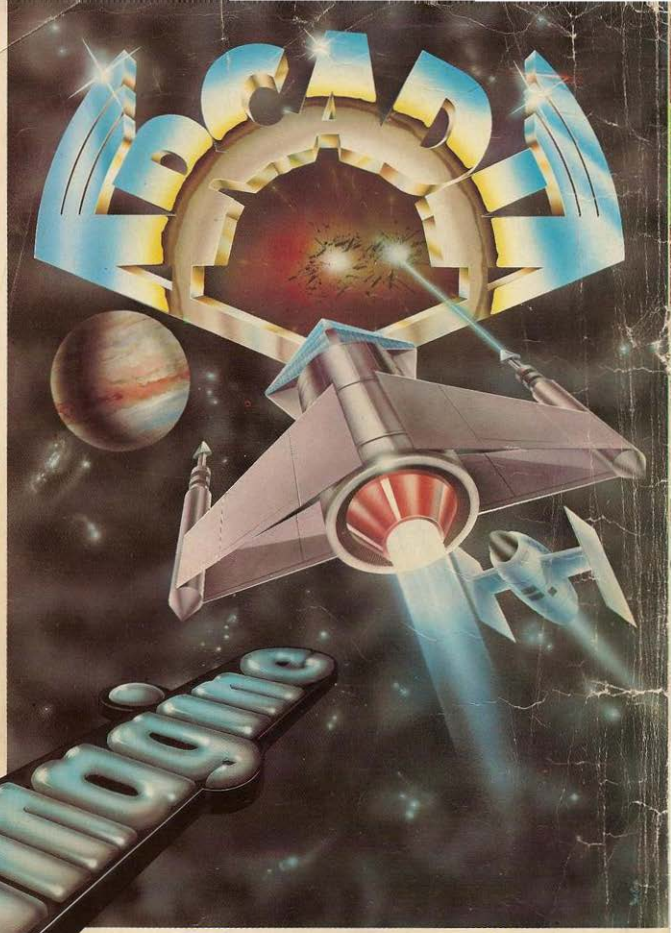
100% machine code with 12 different alien types, incredible animation and explosive effects, sound and the fastest, smoothest hi-res graphics ever!

VIC-20

(any memory size)

100% machine code with eight different alien types, smooth hi-res multicolour graphics and animation, narrow playfield and sensational sound effects. Keyboard or joystick.

Game design and software by D. H. Lawson.



ARCADIA

For any ZXSPECTRUM or VIC-20. Just

£5.50

which includes first class postage and packing, V.A.T., and an **UNCONDITIONAL LIFETIME GUARANTEE.**

When you buy **ARCADIA** you buy it for life. If an Imagine software product EVER fails to load first time simply return it to Imagine for an instant free replacement.

ALL ORDERS DISPATCHED BY FIRST CLASS POST WITHIN 24 HOURS OF RECEIPT.

Imagine Software
Masons Buildings, Exchange Street East,
Liverpool, Merseyside L2 3PN.

Access **SUPERFAST CREDIT CARD SALES LINE: 051 236 6849 (24hrs)** BARCLAYCARD VISA

See our advertisement on pages 132 and 133

Why not put a first class stamp on your order and you will receive ARCADIA within 3 days of posting. Please allow for Xmas post!

Post coupon now to: YC2
Imagine Software
Masons Buildings, Exchange Street East,
Liverpool, Merseyside L2 3PN.

Please rush me a copy of ARCADIA for (tick box):
☐ **Any ZX Spectrum** ☐ **Any Commodore VIC-20**

*Please debit my Barclaycard/Access
I enclose Cheque/P.O. for £
*Delete as applicable

Name: _____

Address: _____